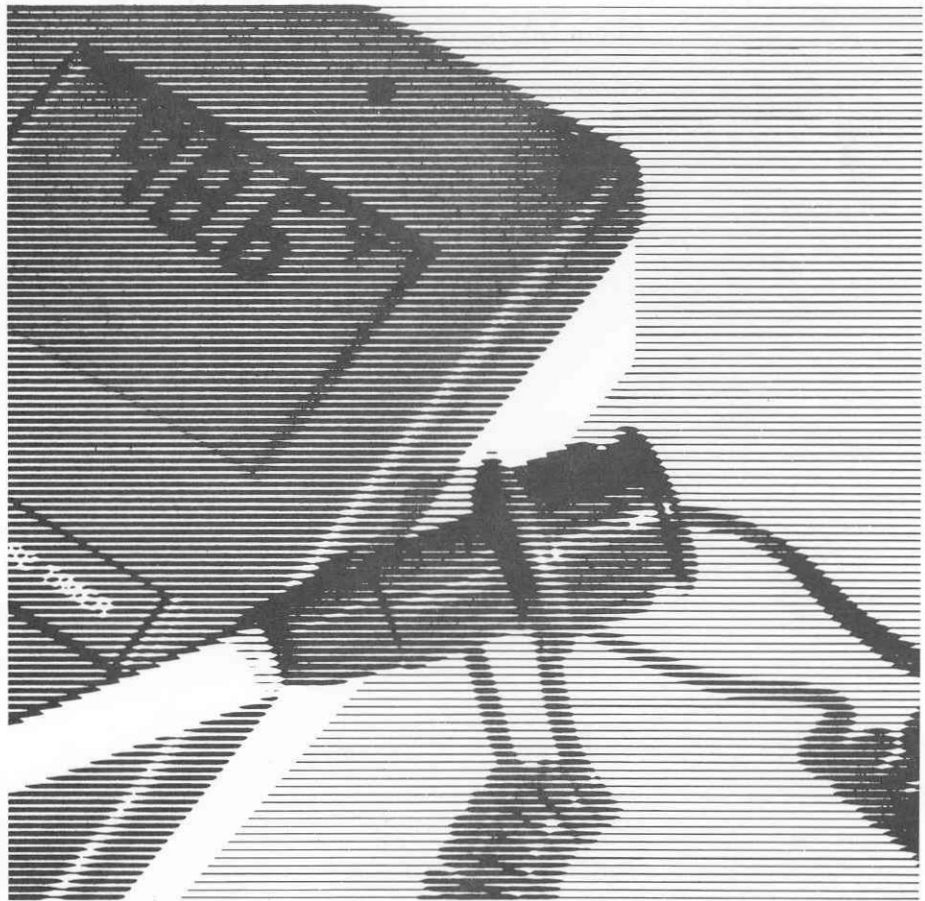




IVAC[®] TEMP•PLUS[®] II
SERVICE MANUAL

VITAL SIGNS

MEASUREMENT SYSTEM

MODEL 2080

Patent Information

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1.0 GENERAL INFORMATION

This publication contains information for use in maintaining and servicing the IVAC TEMP•PLUS II Vital Signs Measurement System - Model 2080 (Figure 1-1). The system consists of the TEMP•PLUS II unit, the home base, and the IVAC probe assemblies, Model 2880/2882.

This manual is written for personnel experienced in analyzing, trouble-shooting, and repairing analog and digital electronic equipment. For reference purposes, portions of the Directions For Use, which accompany each instrument, are included in Chapter 2 of this manual.

1.1 Definition of Terms

The following are definitions of certain terms and concepts used throughout this manual:

NOTE: Notes found in the text indicate parenthetical information which is of particular importance to the reader.

WARNING: Warnings are precautionary measures which, if not followed, could cause personal injury.

CAUTION: Cautions are precautionary measures which, if not followed, could cause damage to the Model 2080 Thermometer, or could cause an inaccurate vital signs measurement.

1.2 Specifications

The specifications for the Model 2080 Thermometer are contained in Table 1-1.

1.3 Abbreviations

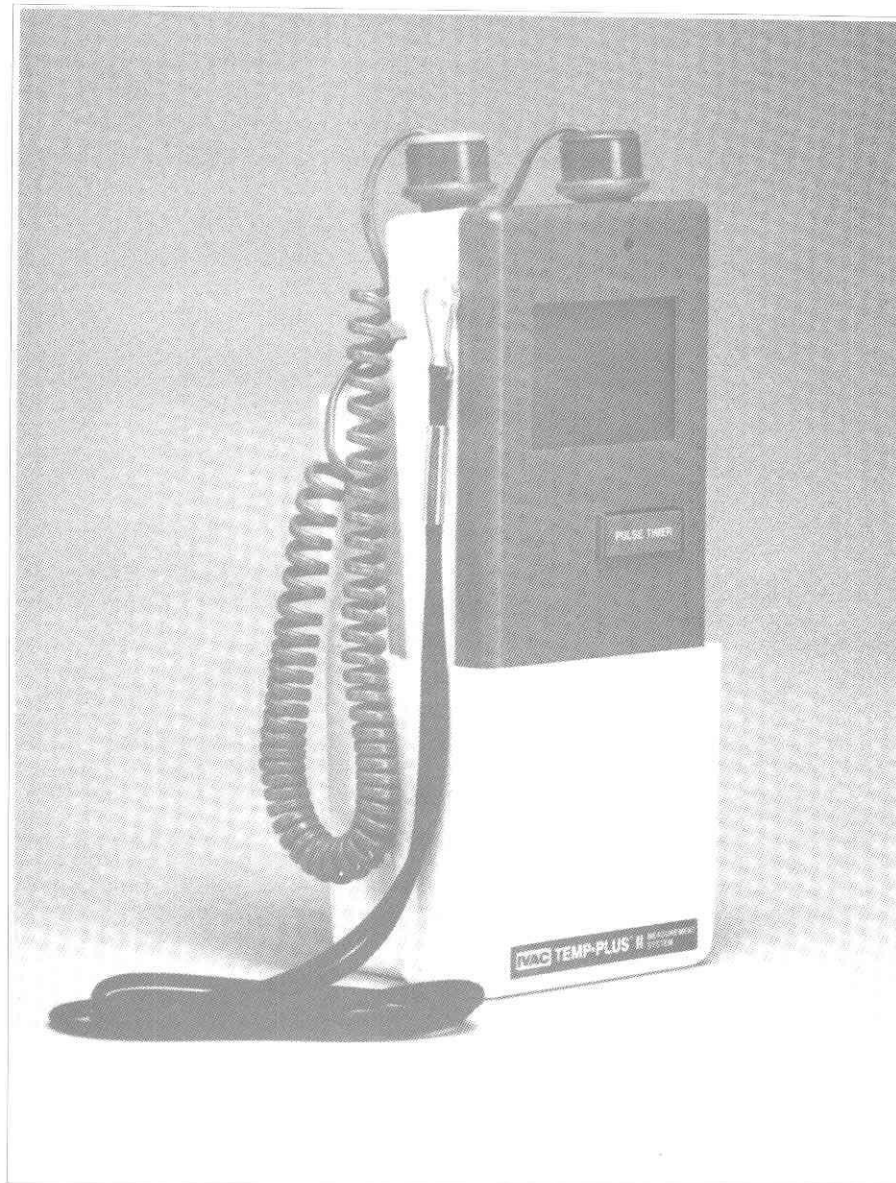
The reference designations and abbreviations used throughout this manual are contained in Table 1-2.

1.4 Features

The many features of the Model 2080 Thermometer include:

- Digital display of temperature readings in user selectable Fahrenheit or Celsius
- Powered by readily available disposable batteries (size AA)
- Automatic turn-on and turn-off
- Two probe wells to accommodate oral (blue) and rectal (red) probes
- Recalls last temperature reading
- Audible tone signals final temperature reading
- Internal timer to deter theft
- Broken probe indicator
- Large display panel with automatic backlight
- Pulse timer display with audible indicator at fifteen, thirty and sixty-seconds for timing pulse rate and respiration rate

Figure 1-1. IVAC TEMP•PLUS II
- Model 2080 Thermometer.



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- Tissue contact pinwheel display indicates tissue contact
- Performs self-tests and auto calibration
- Adaptable for use with monitor probes
- Uses clean, disposable probe covers
- Rugged design and construction utilizing advanced microprocessor technology
- Suitable for use with electrically susceptible patients (UL type A, NFPA Class ES-1)
- Home base for storage

Table 1-1. Specifications and Features

FEATURES	SPECIFICATIONS
RANGE:	
Normal Operation	31.6°C to 42.2°C 88.9°F to 108.0°F
Monitor Mode	26.7°C to 42.2°C 80.0°F to 108.0°F
Pulse Timer	0 to 60 seconds
ACCURACY:	±0.2°F (±0.1°C) (when tested with Model 2880 probe in calibrated water bath)*
BATTERIES:	
Type	Three (3) AA size alkaline cells
DIMENSIONS:	
Length	6.88 inches (17.50 cm)
Width	2.88 inches (7.30 cm)
Depth	2.23 inches (5.70 cm)
Weight	0.75 pounds (341 grams)
ENVIRONMENT:	
Temperature:	
Storage and Shipping	-25 to 140°F (-32 to 60°C)
Operating - Normal Mode	60 to 92°F (16 to 33°C)
Operating - Monitor Mode	60 to 110°F (16 to 43°C)
Humidity: Storage, Shipping and Operating:	15 to 95% relative humidity, non-condensing
CASE:	Durable, lightweight, ABS plastic
*Meets ASTM Specification #E 1112, Table 1, in range specified.	

Table 1-2. Reference Designations and Abbreviations

C	= capacitor	R	= resistor
CR	= diode	RN	= resistor network
DS	= display	S	= switch
E	= PC jumper	T	= transformer
J	= connector, terminal header	TP	= test point
LDR	= light dependent resistor	U	= integrated circuit
LS	= speaker	Y	= quartz crystal
Q	= transistor		

Abbreviations

A	= ampere	m	= milli
A/D	= analog to digital	MΩ	= megohm
Ah	= ampere-hour	mA	= milliamperes
AR	= as required	min	= minute
BCD	= binary coded decimal	MHz	= megahertz
°C	= degrees Celsius	μF	= microfarad
cm	= centimeter	μsec	= microsecond
CMOS	= complementary metal-oxide semiconductor	N/A	= not applicable
COML	= commercial	no.	= number
CPU	= central processing unit	nos.	= numbers
D/A	= digital to analog	Ω	= ohm
dB	= decibel	p	= pico
dia	= diameter	pF	= picofarad
F	= farad	P/N	= part number
°F	= degrees Fahrenheit	PW	= printed wiring
Hz	= hertz	RAM	= random access memory
hr	= hour	ROM	= read-only memory
IC	= integrated circuit	sec	= second
in.	= inch	S/N	= serial number
KΩ	= kilohm	V	= volt
kg	= kilogram	VAC	= volts alternating current
kHz	= kilohertz	VDC	= volts direct current
kV	= kilovolts	W	= watt
lb	= pound		

1.5 Accessories

- a. IVAC Standard Probes - Models 2880/2882 (oral/rectal) (Figure 1-2). The Model 2880/2882 probes contain a heat-sensing thermistor located inside a flexible plastic shaft. The thermistor provides a temperature-proportional resistance to the thermometer through the probe connection and flexible 6½ inch coil cord (extendable to 14 inches) attached to the base of the probe shaft. Also located at the base of the probe is an ejection button for easy disposal of used probe covers. Oral probes are blue, rectal probes are red; the oral and rectal probes are electrically identical.

- b. IVAC Probe Cover - Model 850 (Figure 1-2). The probe cover is a thin plastic sheath with thermal characteristics carefully selected to match the requirements of the TEMP•PLUS II Thermometer. The probe cover is used to cover the shaft of the probe to aid in the prevention of cross-contamination or infection during temperature measurement.

NOTE

IVAC Corporation does not guarantee the accuracy of the temperature readings obtained unless genuine IVAC probes and probe covers are used with the TEMP•PLUS II Thermometer. Inaccurate readings may occur unless IVAC probe covers, or probe covers having thermal characteristics equivalent to those of IVAC probe covers, are used.

- c. IVAC Probe Cover Dispenser Bracket - Model 896 (Figure 1-3). Stores box of 200 probe covers for easy access. Attaches by adhesive mounting tape or screws (included).
- d. IVAC Home Base - Model 2017 (Figure 1-4). Used for storage of the Model 2080 when not in use, and for resetting the antitheft feature. Attaches to either horizontal or vertical surface by adhesive mounting tape or screws (supplied).
- e. IVAC Monitor Probe Adapter - Model 2868 (Figure 1-5). Used with disposable probes (see sections f., and g., below) for monitoring patient temperatures. All disposable probes are to be used on a single patient and then thrown away. Probe covers are not required. Use of the Monitor Probe Adapter automatically causes the instrument to function in monitor mode.
- f. Disposable Skin Surface Temperature Probe - Model 40602 and IVAC TEMP•PAD™ - Model 40702 (Figure 1-6). The skin surface probe comes with a 5/8 inch diameter foam adhesive for initial surface attachment. The TEMP•PAD is a self-adhesive pad (with peel-off backing) used for reaffixing the disposable probe when used again on the same patient. Skin surface probes may be used more than once on the same patient (reaffix with the IVAC TEMP•PAD).
- g. IVAC Probe Extension Cable - Model P869 (Figure 1-7). The probe extension cable is a 6-foot long connecting cable which attaches to both the TEMP•PLUS II Thermometer and the disposable probe, providing a reusable extension for the disposable probe.
- h. Thermometer Stand - Model 2021 (Figure 1-8). The stand has a four legged base with rolling casters for easy maneuverability, and is designed to hold one Model 2080 instrument with home base.

Figure 1-2. Model 2880/2882 Probes with Model 850 Probe Cover.

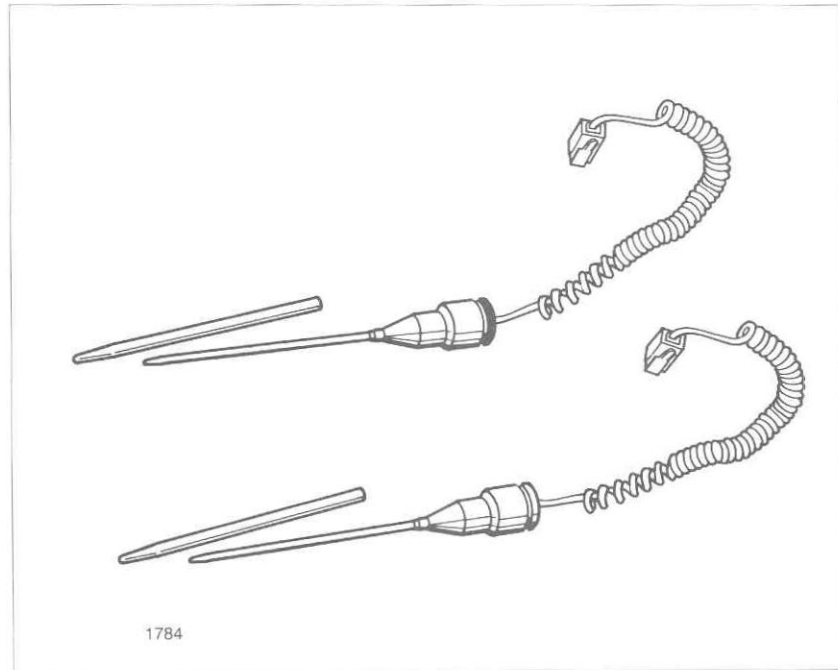


Figure 1-3. IVAC Probe Cover Dispenser Bracket - Model 896.



Figure 1-4. IVAC Home Base - Model 2017.

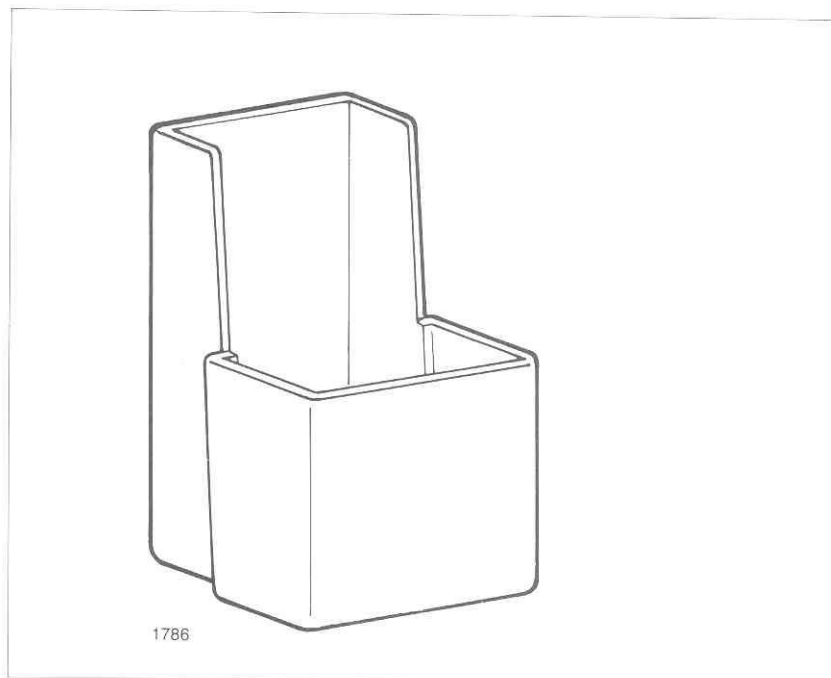


Figure 1-5. IVAC Monitor Probe Adapter - Model 2868.

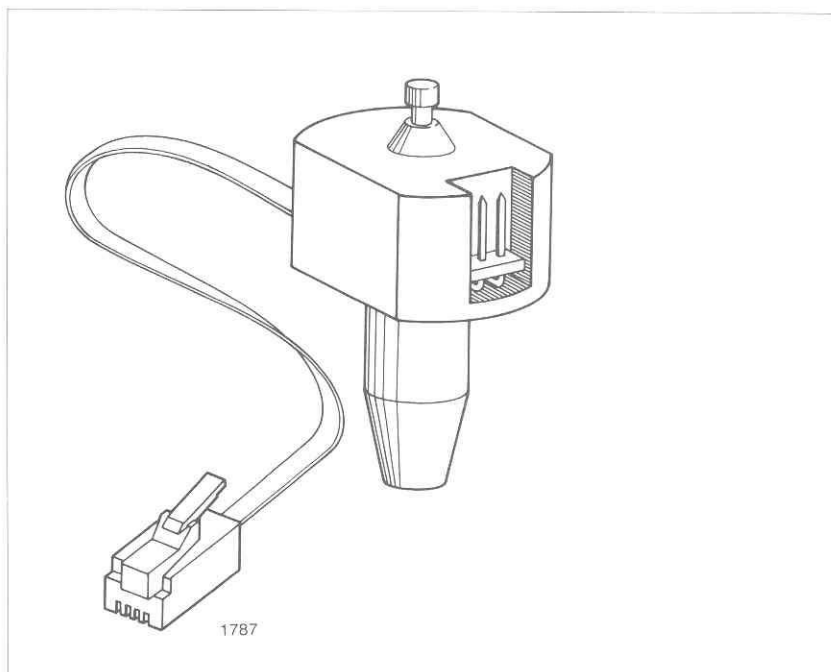


Figure 1-6. Disposable Skin Surface Temperature Probe - Model 40602 and IVAC TEMP•PAD - Model 40702.

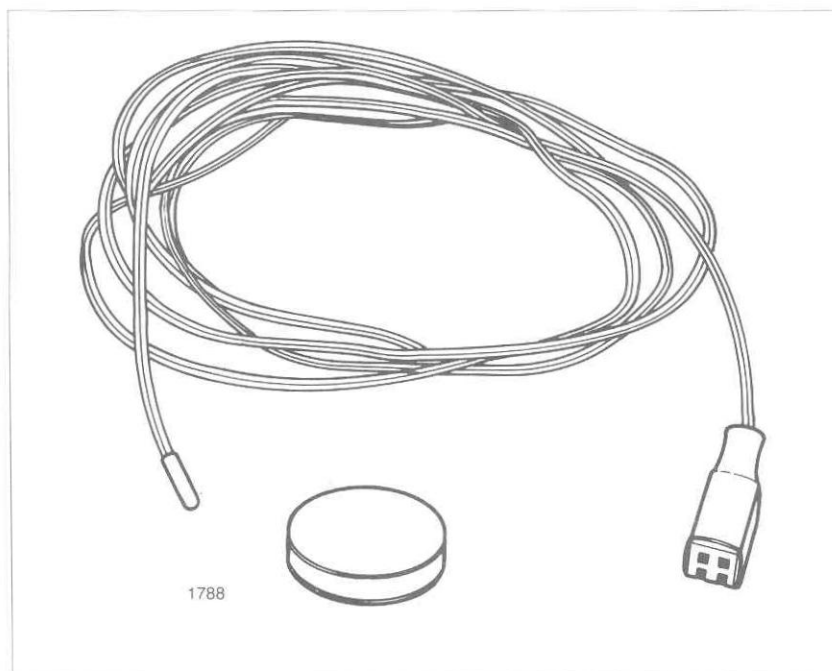


Figure 1-7. IVAC Probe Extension Cable - Model P869.

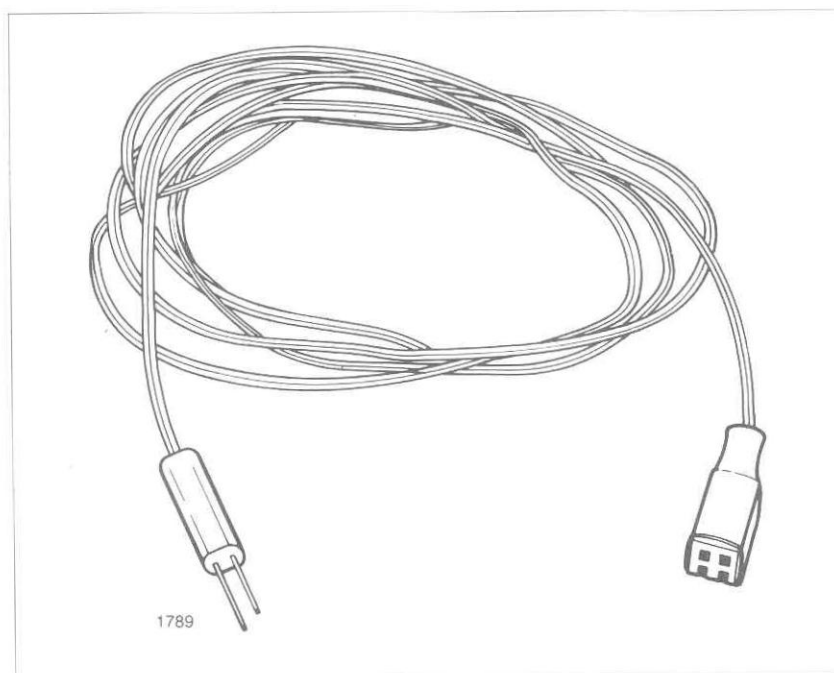
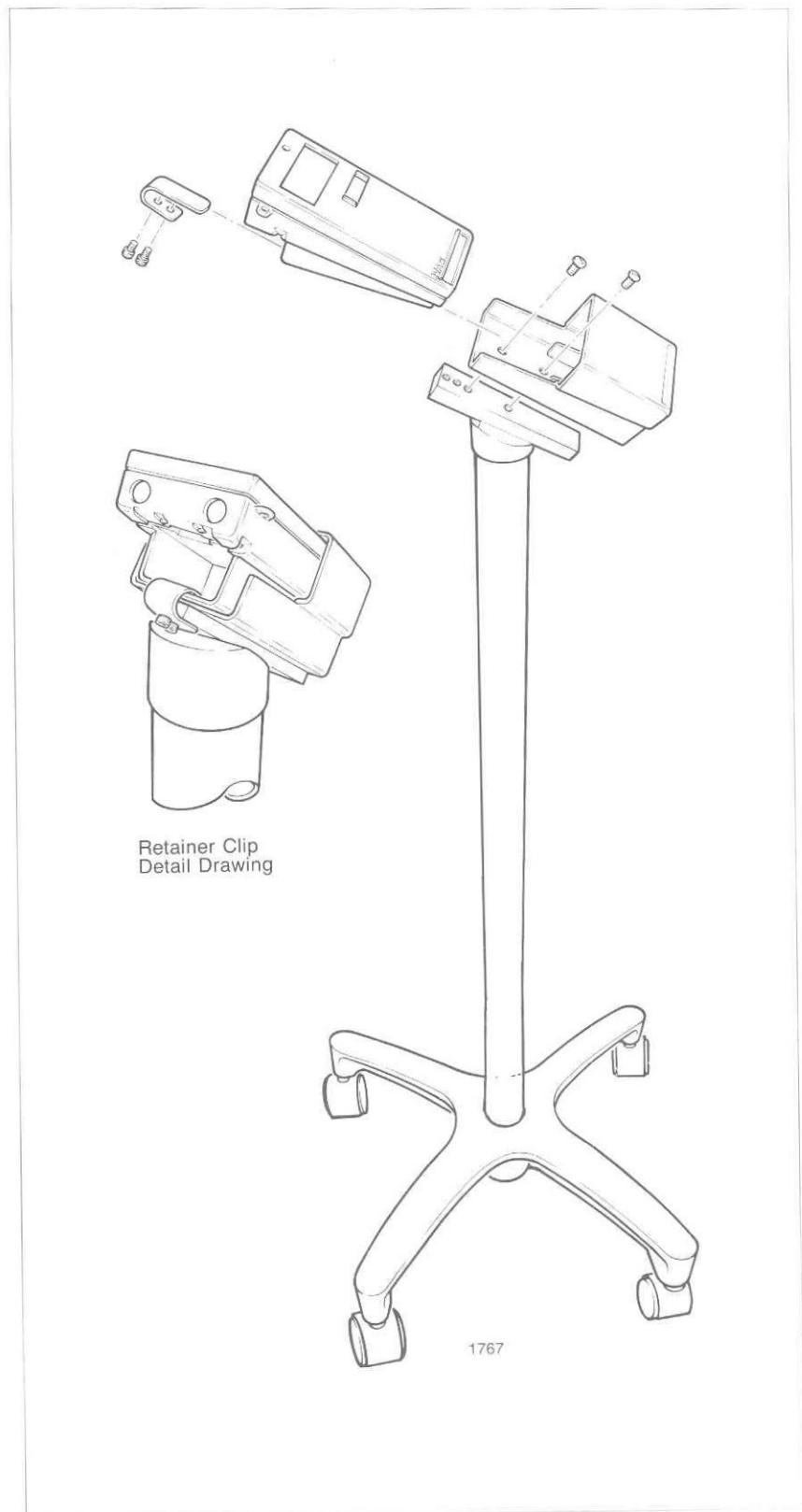


Figure 1-8. Thermometer Stand
- Model 2021.



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2.0 INTRODUCTION

This chapter describes the operation of the Model 2080 Thermometer, primarily for testing purposes. Detailed operating instructions for patient use are given in the Directions For Use manual which is packaged with each instrument. All controls and indicators used to operate the TEMP•PLUS II Thermometer are described and illustrated in the following paragraphs.

2.1 Controls and Indicators

The controls and indicators listed in Table 2-1 are used in the operation of the Model 2080 Thermometer.

Table 2-1. Controls and Indicators

<i>CONTROL / INDICATOR</i>	<i>FUNCTION</i>
Pulse Timer Button	Starts pulse clock, recalls last reading, and, in monitor mode, activates backlight.
°F/°C Switch	Selects whether temperature will be displayed in °F or °C (°C = ON).
Audible Tone	Sounds when measurement is completed, when pulse timer is activated or terminated, or when an error message occurs.
Display Panel	LCD display indicating temperature readings, tissue contact pinwheel, pulse timer clock, alarm messages, temperature scale, and mode in use.

2.2 Setup Procedure

- Carefully unpack the TEMP•PLUS II Thermometer, oral and rectal probes, and carrying strap, checking to ensure that each item is undamaged.
- Using the adhesive mounting tape or mounting screws supplied, attach the Probe Cover Dispenser Bracket (Model 896) to a convenient location and install a box of 200 probe covers.
- Attach the Home Base (Model 2017) to a convenient location using either the adhesive tape or screws supplied with the instrument. The home base may be attached to either a horizontal or vertical surface.
- Battery covers are not installed when units are shipped. (To remove battery cover (Figure 2-1) once cover has been installed in unit, place a coin in the slot on the side of the battery cover and pop open the battery compartment.) Set the instrument to the °F (Fahrenheit) or °C (Celsius) scale, as desired, by adjusting the recessed switch on the left side of the battery compartment with a small screwdriver or pen tip (°F = OFF).

Operation

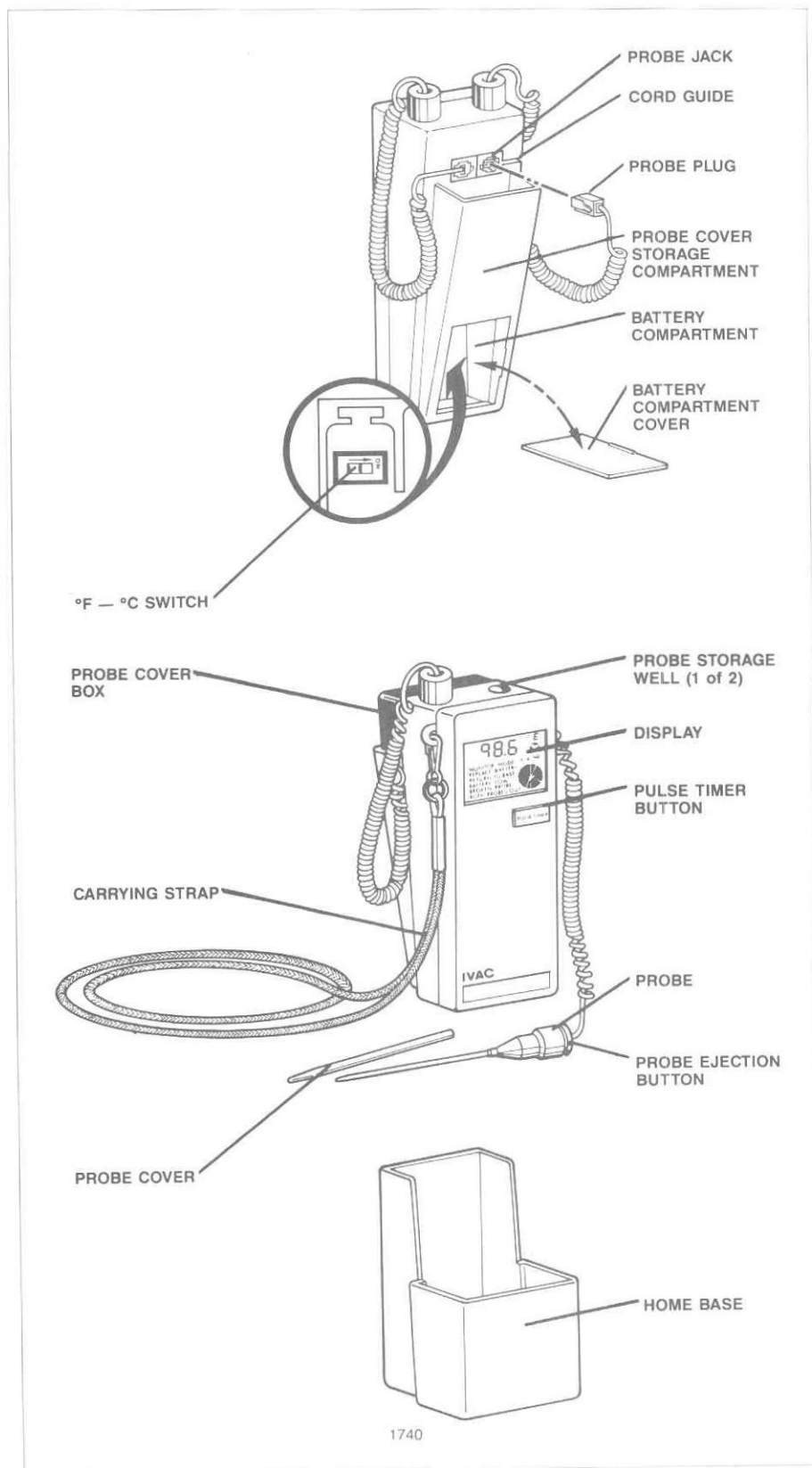
- e. Install 3 size AA batteries and install cover. **NOTE:** Batteries must be installed exactly as shown on the battery compartment or the instrument will not function. To prevent damage to the battery contacts, install negative end of battery first.

NOTE

Whenever batteries are removed and replaced, the instrument will perform a self-test of the instrument hardware which will take about two minutes. Should the instrument fail a self-test, a FIX ME message along with a code number will appear in the display. Refer to the Corrective Maintenance section of this manual for further information. At the end of the self-test, the instrument will emit three beeps and display RETURN TO BASE. The TEMP•PLUS II unit must be returned to the home base to reset the antitheft timer whenever batteries are removed and replaced.

- f. Insert the connectors from the probes (oral or rectal) into the probe connector sockets on the instrument, and route the probe cord through the cord guide (see Figure 2-1). Insert the probes into the probe storage wells in the top of the instrument.

Figure 2-1. Model 2080 Component Identification.



Operation

CAUTION

Do not use with extender cables between 2880/2882 probe cable and instrument.

- g. Attach carrying strap to thermometer, if desired.
- h. Place the instrument in the home base to activate.

2.3 HOME BASE

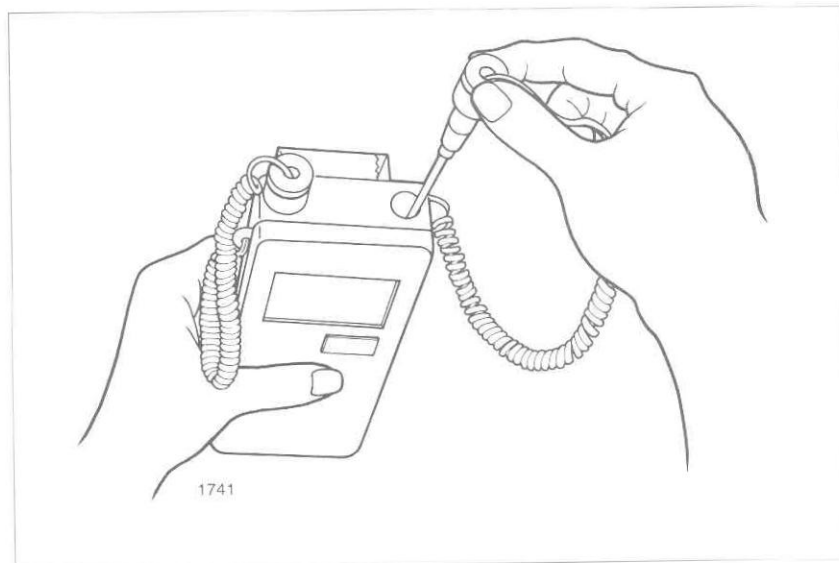
- a. Place the TEMP•PLUS II Thermometer in the home base before using it for the first time or the instrument will not operate. The instrument must also be returned to the home base whenever the batteries are removed and replaced. Always store the instrument in the home base when not in use.
- b. The antitheft timer is reset by returning the thermometer to the home base. Approximately one hour prior to expiration of the predetermined time period, the instrument will continuously display RETURN TO BASE as a warning. When the time period expires, the instrument will emit three long beeps, flash the RETURN TO BASE message and cease to function.

2.4 Start-up/Operational Check

Remove the instrument from the home base and install a box of 20 probe covers in the storage compartment at the rear of the instrument. Place the carrying strap around your neck, if desired.

With your thumb and forefinger, grasp the base of the probe and withdraw the probe from the probe storage well (see Figure 2-2). This action automatically turns on the instrument. Verify that all display segments, except the pulse timer clock, momentarily light and that the instrument beeps once (instrument will beep twice in monitor mode). When this sequence is complete, the instrument will display 80°F (26.7°C) indicating the instrument is ready for use.

Figure 2-2. Withdrawing Probe from Probe Storage Well.



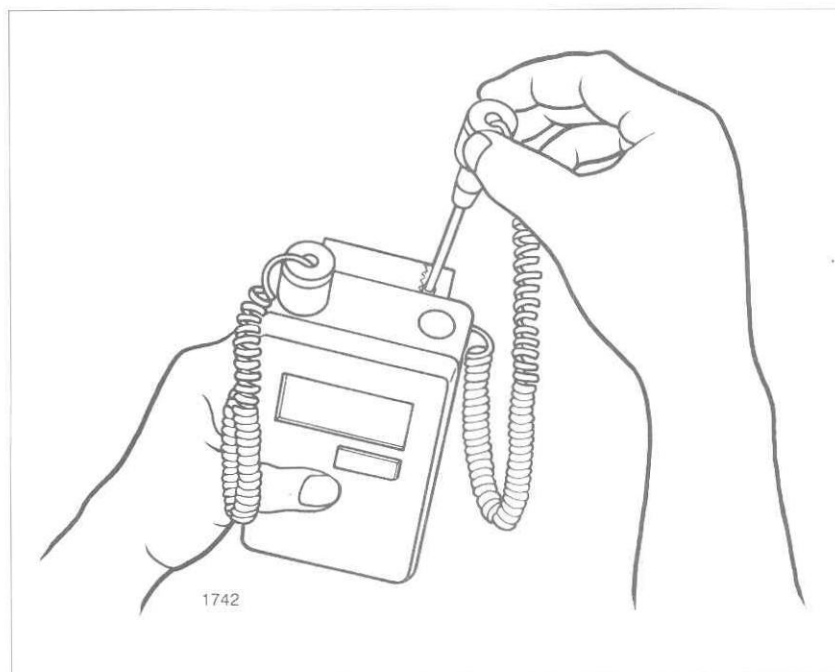
2.5 Normal Use Operating Instructions

Insert the probe completely and firmly into a probe cover to ensure a secure fit (see Figure 2-3). Failure to firmly install the probe cover may result in the probe cover becoming loose or disengaging during use. Be careful not to press the colored button where the cord exits the probe as this might loosen or eject the probe cover.

CAUTION

Use only IVAC P850 Probe Covers with the TEMP•PLUS II unit. The size, shape, and thermal characteristics of the probe covers can affect the performance of the TEMP•PLUS II Thermometer. Inaccurate readings or retention problems may occur unless IVAC probe covers are used.

Figure 2-3. Applying Probe Cover.



2.5.1 Oral Temperature Measurement. For oral temperature measurement use the blue, oral probe.

- Have patient open mouth slightly. Holding the probe loosely, insert probe tip to the sublingual pocket where the richest blood supply is located (see Figures 2-4 and 2-5).
- Hold the probe during the entire temperature measurement process (see Figure 2-6) and keep the probe tip in contact with tissue at all times. Do not allow patient to reposition the probe.
- The tissue contact pinwheel will appear in the top right corner of the display while the patient's temperature is being determined. When the

measurement is complete, an audible tone will sound, the pinwheel will disappear, the display stops advancing, and the patient's final temperature reading (in degrees and tenths of a degree) will appear on the display panel. The display will clear as the probe is returned to the storage well.

Figure 2-4. Sublingual Pocket.

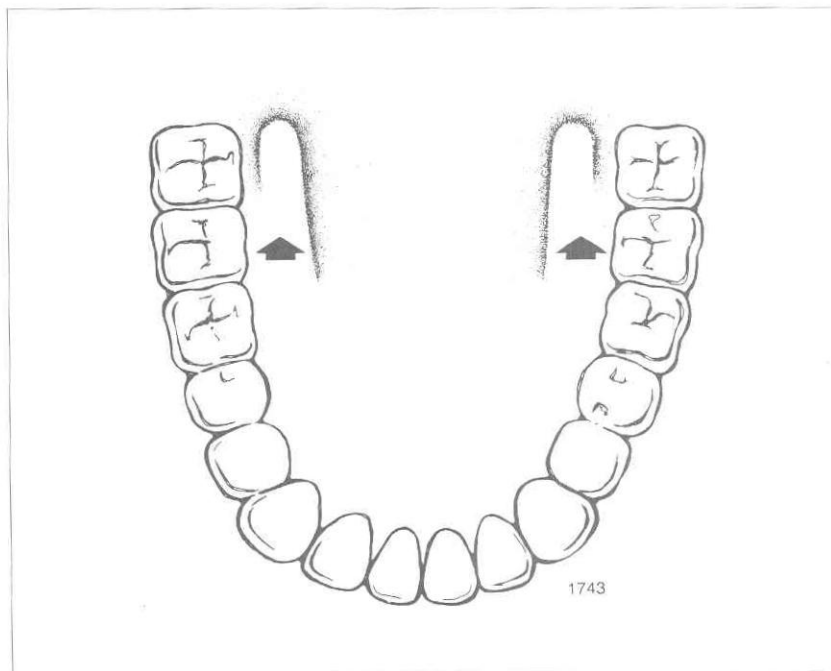


Figure 2-5. Sublingual Pocket - Side View.

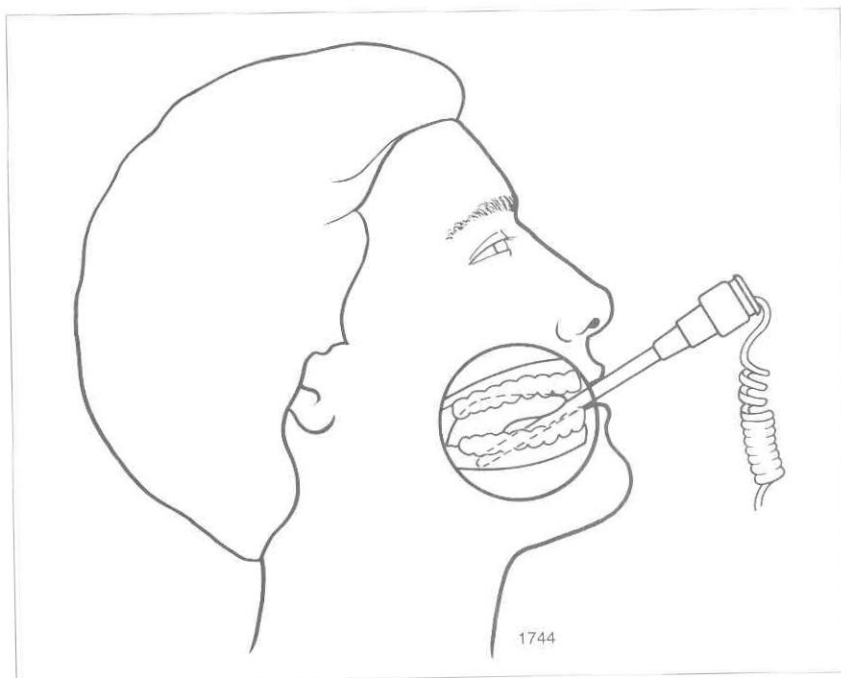
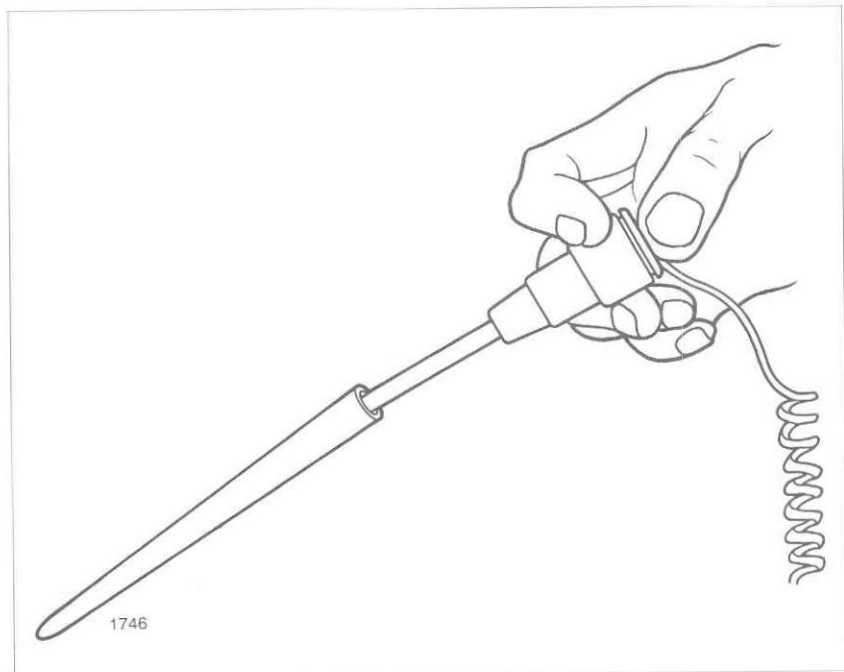


Figure 2-6. Oral Temperature Technique.



Figure 2-7. Ejecting Probe Cover.



NOTE

If the probe tip temperature is higher than 92.0°F (33.3°C) when the probe is taken out of the probe well, the thermometer will not be able to quickly predict the patient's temperature. Instead, the thermometer will automatically go into monitor mode. A correct final temperature reading may require 3 minutes or longer. The instrument will not beep at final temperature. It will continue to monitor the patient's temperature until the probe is removed from the patient and returned to the storage well.

- d. Note the displayed temperature and remove the probe from the patient's mouth. Hold the probe as you would a syringe and press the colored ejection button at the base of the probe to eject the used probe cover into a waste container (see Figure 2-7).
- e. Return the probe to the probe storage well. This will automatically turn off and reset the thermometer for the next temperature.

NOTE

To recall the last temperature reading, press PULSE TIMER button. DO NOT withdraw probe from storage well as this will cause memory to be erased.

NOTE

If an unusually high or low temperature reading is obtained, reconfirm the reading before beginning treatment.

2.5.2 Rectal Temperature Measurement. For rectal temperature measurement use the red, rectal probe. Insert the probe completely and firmly into a cover. Failure to firmly install the probe cover may result in the probe cover becoming loose or disengaging during use. Be careful not to press the colored button where the cord exits the probe as this might loosen or eject the probe cover.

- a. Touch the tissue about a half inch above the sphincter muscle and carefully insert the probe, using current hospital technique for penetration. (The use of a lubricant is optional.)
- b. To ensure continuous tissue contact and maximize patient comfort, hold the probe in position until the audible tone sounds, indicating the patient's temperature has been reached.
- c. Note the temperature, withdraw the probe, press the colored ejection button to eject the used probe cover and return the probe to the storage well.

2.6 Monitor Mode Operating Instructions

In monitor mode, the TEMP•PLUS II Thermometer continuously measures the patient's temperature as it rises or falls. To operate in monitor mode:

- a. Disconnect one probe connector from the instrument and install a monitor probe adapter (see Figure 1-5). NOTE: The probe adapter can be used with or without an IVAC extension cable.
- b. Attach a disposable monitor probe to the instrument.
- c. Press the adapter ON/OFF switch to turn instrument on. The instrument will emit two beeps, and display the message MONITOR MODE, indicating the start of operation in monitor mode.

NOTE

The **BROKEN PROBE** message will display if the instrument is turned on before attaching a disposable monitor probe. To reset the instrument, attach the monitor probe, and cycle the instrument off then on by pressing the adapter ON/OFF switch. If message repeats, refer to the Corrective Maintenance section of this manual.

- d. After positioning the probe, observe the changing display reading. When the display stops changing (this may take longer than 3 minutes), the patient's current temperature is indicated on the display, and will change as the patient's temperature rises or falls.

NOTE

The monitor probe adapter ON/OFF switch turns the instrument on. The instrument will continue to run while probe adapter switch is on. To conserve batteries, the instrument should be turned off when not in use.

NOTE

To activate backlight while in monitor mode, press the **PULSE TIMER** button. Press again to turn backlight off.

2.6.1 Axillary Temperature Measurement**2.6.1.1 Method I**

Axillary temperatures may be obtained using regular oral or rectal probes.

- a. Select and remove one probe and attach a probe cover.
- b. Place probe in patient's axilla, making sure the tip of the probe is in contact with the skin and positioned as close as possible to the axillary artery with the patient's arm held close to their side (see Figure 2-8).
- c. As the temperature display reads 92.0°F (33.3°C), remove second probe from storage well. Watch for **BOTH PROBES OUT** to appear in the display, then reinsert second probe into storage well.

Figure 2-8. Axillary Temperature Technique.



Operation

- d. The display will momentarily indicate 80.0°F (26.7°C) before switching to monitor mode. (MONITOR MODE will appear in the display indicating start of monitor mode measurement.)

NOTE

If the probe tip temperature is higher than 92°F (33°C) when the probe is removed from the probe well, steps c and d of this procedure will not be necessary.

- e. Leave probe in place for the same length of time as required by standard hospital procedure for taking an axillary temperature (the instrument will not beep to indicate final temperature reading).
- f. Note patient's temperature, remove probe, eject probe cover, and return probe to storage well.

2.6.1.2 Method II

- a. Insert a Monitor Probe Adapter (Model 2868 - See Figure 1-5) into either probe well of the instrument and plug it into the connector.
- b. Connect a Disposable Skin Surface Probe (Model 40602 - see Figure 1-6) to the monitor probe adapter and affix an IVAC TEMP•PAD - Model 40702 to the probe.
- c. Place the skin surface probe in patient's axilla, positioned as close as possible to the axillary artery, with the patient's arm held close to their side.
- d. Turn adapter on by pressing button on top of adapter.
- e. Leave probe in place for the same length of time as required by standard hospital procedure for taking an axillary temperature (the instrument will not beep to indicate a final temperature reading).
- f. When finished, remove probe and turn off or disconnect the monitor probe adapter. This will turn instrument off. NOTE: Skin surface probes may be used more than once on the same patient (reaffix with an IVAC TEMP•PAD) but must be thrown away following the completion of a measurement cycle.

2.7 Pulse Timer Operation

The pulse timer feature is intended to be used in the same manner as you would use a watch for calculating heart rate. This feature is operational during a temperature measurement.

- a. Hold the TEMP•PLUS II Thermometer in one hand so you can easily press the PULSE TIMER button (see Figure 2-9). With your free hand, locate patient's pulse.
- b. Begin taking pulse and, at the same time, press the PULSE TIMER button. The instrument will emit a single short beep to indicate the start of the pulse timer clock. All twelve segments of the clock will come on. One segment will turn off every five seconds, moving sequentially around the clock, starting at 12 o'clock. The last segment turns off at 60 seconds. The instrument will beep once at 15 seconds, beep twice at 30 seconds, and beep three times and turn off at 60 seconds. Pulse is calculated in the same manner as using a stopwatch.

- c. Pulse Timer operation can be terminated at any time by pressing the PULSE TIMER button. The instrument will emit three short beeps to indicate termination and the pulse timer display will turn off.

Figure 2-9. Pulse Timer Technique.



2.8 Information Display

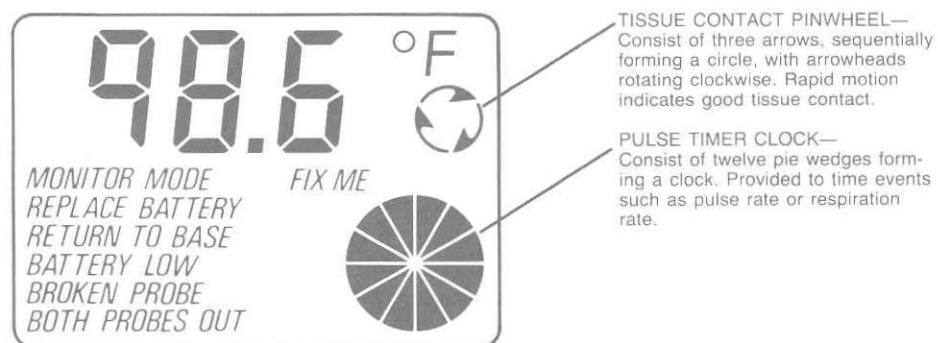
- a. TISSUE CONTACT PINWHEEL - Consists of three arrows, sequentially forming a circle, with arrowheads rotating clockwise. Rapid motion indicates good tissue contact.
- b. FIX ME - (accompanied by three long beeps and a number) indicates instrument detects a self-test failure. Instrument operation is discontinued until the failure is corrected. Remove one battery, then reinstall battery. The instrument will run through self-test routine. If the fix me message appears again, record the fix me number and refer to the Corrective Maintenance section of this manual.
- c. PULSE TIMER CLOCK - Consists of twelve pie wedges forming a clock. Provided to time events such as pulse rate or respiration rate.
- d. MONITOR MODE indicates instrument is being used with a monitor probe to continuously track a patient's temperature. The temperature is indicated on the display and will change as the patient's temperature rises or falls.

Operation

NOTE

If a monitor probe is not being used with the instrument and this message appears, it indicates that the instrument attempted a temperature measurement when the starting probe tip temperature was above 92.0°F (33.3°C). The instrument is unable to quickly "predict" a patient's temperature, so it automatically switches to monitor mode. The temperature on the display will slowly rise and may require 3 minutes or longer before final temperature is reached. In extreme heat an alcohol wipe may be used, on the probe shaft only, to lower the probe tip temperature.

- e. BATTERY LOW indicates batteries are low and need replacing soon.
- f. REPLACE BATTERY indicates the batteries are unusable and must be replaced.
- g. RETURN TO BASE displayed continuously indicates that approximately one hour or less remains before the expiration of the predetermined antitheft time period (hospital selected). When the time period expires, the instrument will emit three long beeps, flash RETURN TO BASE and cease to function. Return to home base to reset the antitheft timer.
- h. BROKEN PROBE (accompanied by three beeps and broken probe number) indicates a probe is broken and needs to be replaced.
- i. BOTH PROBES OUT indicates both probes are withdrawn from the probe storage wells. The instrument will not run with both probes withdrawn. The message will continue to display until at least one probe is returned to the probe storage well, or one of the probes is disconnected from the instrument.



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2.9 Cleaning

Do not autoclave or immerse the TEMP•PLUS II Thermometer as damage will occur.

It is good practice to periodically clean the instrument surface by wiping it with a soft cloth dampened with a mild detergent and warm water. Refer to Housekeeping, Central Service or Infection Control departments in your facility for further information.

CAUTION

DO NOT USE ALCOHOL, AMMONIA, OR AMMONIUM CHLORIDE—BASED AGENTS as they will damage the plastic exterior of the instrument.

If you currently use a specific cleaning agent or disinfectant, we recommend that you examine its chemical ingredients prior to use on the thermometer. If you question the effect your specific cleaning agent or disinfectant has on your instrument, call IVAC Customer Service at (800) 482-4822 for assistance. In Canada, call (416) 291-5858. Outside North America, contact locally listed IVAC representatives, or designated IVAC distributors.

Chapter Three ***Functional Description***

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3.0 INTRODUCTION

This chapter contains a functional description of the TEMP•PLUS II - Model 2080 Thermometer. The functional description of the logic signals and individual circuits is supported by a block diagram (Figure 3-1). Detailed system operation is shown in the schematic diagram (Figure 3-5) at the end of this chapter. Integrated circuits are identified in the text with the number shown on the schematic diagram. The reference designation letter is followed by a number, dash, and the pin number.

3.1 OVERVIEW (See Figures 3-1 and 3-5)

The Model 2080 is based on an NEC uPD7503 microcomputer with 4K bytes of program memory and a 224 x 4 RAM. A multiplexed LCD driver, I/O ports, counter-timer and clock generators are included in the microcomputer. The microcomputer controls all functions in the instrument, and is powered at all times to maintain the antitheft feature.

Analog to Digital conversion is performed using a dual slope method where the analog portion is implemented with discrete components and the control logic and counting is implemented in the microcomputer software and hardware. Conversions are performed with a resolution of 11 bits.

The reference supply provides the operating voltage (nominally 1.25 volts) to the resistor networks. This voltage level was selected to maximize voltage swing at the thermistor output without exceeding the maximum power dissipation criteria of the probe. The precise voltage and long term drift are of no consequence, since the analog system is ratiometric.

Adjustments are eliminated by using a resistor network with taps that correspond to standard temperatures that are multiplexed with the probe signals. The instrument's software uses these standard values to standardize and check itself. The input multiplexing system also allows easy implementation of a two-probe system.

Another resistor network supplies reference voltages for the comparators, the integrator and the de-integrate function. A divider is present in this resistor network to scale the battery voltage to a suitable range for the A/D converter for battery monitoring purposes.

The function matrix multiplexes the probe status (in-out, monitor or predict, or absent), the °F/°C selector, the antitheft reed switch and the option and test selectors. Diode logic is used, employing low forward drop Schottky diodes to preserve logic level margins at low battery voltage.

The analog power control enables the analog section only when temperature measurement or battery monitoring functions are performed to minimize battery drain.

Functional Description

The beeper oscillator is a multivibrator that drives a piezoelectric transducer. The oscillator is gated by the microcomputer.

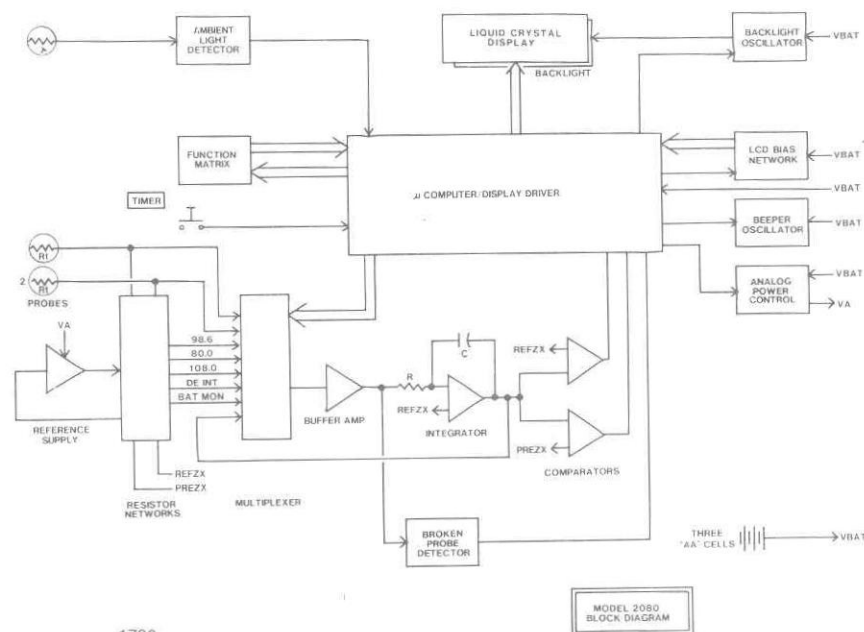
The backlighting system for the display consists of an ambient light detector and an electroluminescent lamp driven by a DC to AC converter. The ambient light detector consists of a cadmium-sulphide cell in a bridge circuit and comparator which is polled by the microcomputer. The microcomputer enables the backlight oscillator (DC to AC converter) when appropriate.

The LCD bias network is a voltage divider which is temperature compensated by a transistor emitter-base junction for the voltage vs. temperature characteristics of the LCD. Three bias levels are provided to the microcomputer to its built-in display driver.

The broken probe detector is a comparator which monitors the probe voltage. It detects an open probe when the probe voltage approaches the reference supply (no current through the thermistor load resistor). The comparator's output is latched to catch intermittently open probes.

Three AA cells provide power to the instrument. The logic and microcomputer are always energized, and the remaining circuits are energized as needed.

Figure 3-1. Model 2080 Block Diagram



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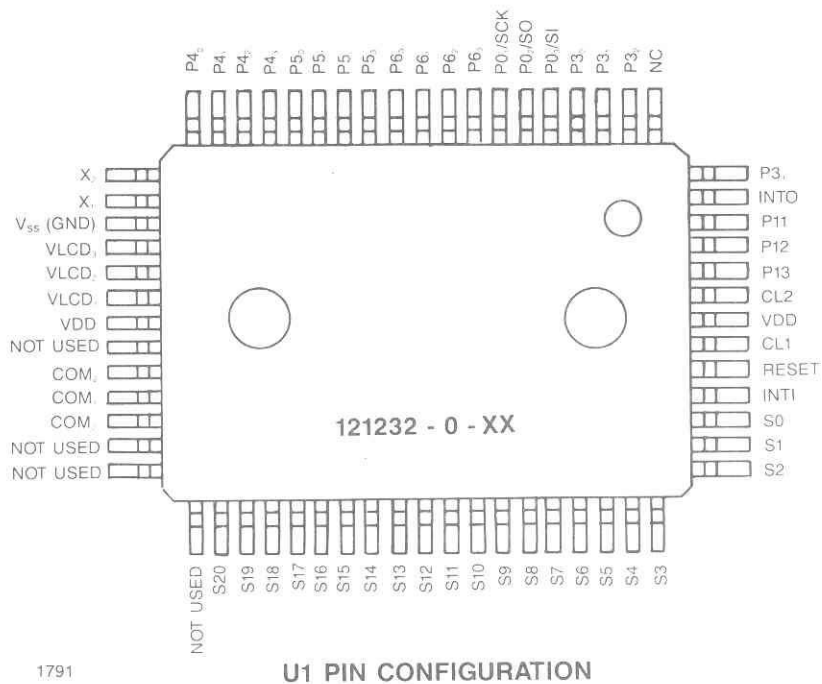
3.2 The Microcomputer

The Model 2080 is based on an NEC uPD7503 low power CMOS microcomputer that has a 4096 x 8 program ROM and a 224 x 4 RAM (see Figure 3-2 for U1 pin configuration). Included in this device is a multiplexed LCD driver which utilizes an external bias source for the LCD. It is mapped to 24 nibbles of RAM to control the activation of individual LCD segments. The uPD7503 has two external interrupts and one internal counter timer interrupt. One serial I/O port is available and reserved for testing functions. Five 4-bit I/O ports are used for various functions, which are described later.

The uPD7503 is initialized upon battery installation (application of power) by the network C10 and R8 at the RESET input to cause diagnostics to be performed (program memory check, RAM check, and analog check).

The uPD7503 has two clock generators. The first (CL1, CL2) is the system clock which operates at a nominal frequency of 100 kHz that is internally divided by two to achieve a 20 microsecond CPU cycle time. This clock is controlled by the time constant of R10 and C11 and has the capability of shutting down during the low power "sleep mode" of the microcomputer. The other clock (X1, X2) utilizes a 32.768 kHz crystal (Y1) and drives the internal timer counter which provides a 5 millisecond time base interrupt to the CPU. This interrupt "wakes up" the CPU, in addition to serving as a timing reference.

Figure 3-2. U1 Pin Configuration



3.3 Analog Section

There are no calibration adjustments in this instrument. Instead, precision resistor networks are used to provide reference voltages for operating, auto-calibration, and probe thermistor loading.

R4 is two thermistor load resistors, each of which actually form half a bridge. A nominal 1.25 volts is applied to the top of R4 and the resistor networks RN1 and RN2 from the reference amplifier section of an LM10 (U3-1). A 200 millivolt tap on RN2 provides feedback (U3-8), which is compared with the internal 200 millivolt reference in the reference amplifier. The 1.25 volt supply is also used in other portions of the analog section, described later.

RN2 is a divider which provides reference levels relative to the 1.25 volt supply to the integrator and comparators. The first tap going to U2-2 (multiplexor input 6) is the de-integrate reference voltage, 0.956 volts (labeled DEINT). The next tap furnishes the reference voltage (0.86 volts) to the pre-zero crossing comparator (labeled PREZX). The next tap (labeled REFZX) is the zero crossing comparator reference and integrator zero count level. This voltage, 0.8294 volts, is equivalent to the input voltage from the thermistor at 77°F (25°C) so that A/D counts start at approximately 77°F (25°C). This gives a margin of approximately 3°F (-16.1°C) below that instrument's 80°F (26.7°C) lower limit, ensuring that a temperature of 80°F (26.7°C) does result in in-range operation. Using this voltage also for the zero crossing comparator reference allows the output of the integrator to be returned back to its input via the multiplexor U2-13 (input 0) for a hold or reset function to initialize the integrator and match the zero crossing threshold within the offset voltages of the integrator amplifier and zero crossing comparator.

RN1 is a divider which furnishes voltages equivalent to 80°F (26.7°C) and 108°F (42.2°C) for auto-calibration and 98.6°F (37.0°C) for calibration check, labeled 80.0, 108.0 and 98.6, respectively. The 98.6 tap has its own resistors because it is used as a check for the 80.0 and 108.0 references.

U-2 is an eight-to-one analog multiplexor which is controlled by port 3 bits 0, 1, and 2 from the microcomputer. The multiplexor serves both as a signal source selector and the controller for the integrating A/D converter. R9 is included on the inhibit input, U2-6, for test purposes. The two probe inputs, U2-5 and 1, are conditioned with low pass filters R6/C9/C22 and R7/C8/C21.

The multiplexor's output is buffered by U4, a high input impedance amplifier to avoid loading the analog sources and to allow for the relatively high "on" resistance of the multiplexor. Pin 8 of U4 is the quiescent current select. In this case, the quiescent current is set to 100 microamperes to allow adequate output sink current to drive the integrator. The integrator is the operational amplifier portion of the LM10, U3-2, 3 and 6, and R30 and C20. Two comparators (U5) are used to determine the end of the de-integration phase of the integrator. The comparator using the reference voltage labeled PREZX interrupts the microcomputer via INT0, indicating that the actual zero crossing is about to occur. This zero crossing anticipation

allows the microcomputer to halt and restart synchronously with the actual zero crossing interrupt via INT1, greatly reducing the latency time uncertainties, increasing the A/D accuracy.

Open-collector pullups R12 and R13 on the comparator outputs are controlled by port 6 bit 2 so that unwanted interrupts do not occur. All timing and resultant count for the dual slope integrator is based on the microcomputer 32.768 kHz clock via the 5 millisecond time base interrupt and counter-timer contents upon zero crossing occurrence.

3.4 Broken Probe Comparator

A comparator, U5-8, is referenced from divider R34/R37 at approximately 0.625 volts. U5-9 input samples the probe voltage via divider R29/R35. If the probe in use were to open-circuit, the probe voltage would approach the 1.25 volt supply, changing the state of the comparator and setting the R-S flip-flop U6. This condition will be sensed via port 6, bit 0. Flip-flop U6 is resettable via port 5, bit 2. The broken probe detector is monitored by the microcomputer only during the integrate cycle of the A/D.

3.5 Ambient Light Detector

A cadmium-sulphide cell (LDR1) senses the ambient light in the area of the display. The cell is in a bridge circuit (in series with R31) with R33 as one side and R34/R37 as the other side. If the ambient light level is below a certain point, the resistance of the cell will increase to the point that the associated comparator's output (U5-13) will go high. This is sensed via port 6, bit 1.

3.6 Function Matrix

A scanned diode matrix is used to read the status of all the function selections in the instrument, except the pulse timer. Port 4 bits 0, 1, 2, and 3, are active high strobes which drive the switches, option and test jumpers, antitheft and °F/°C switches, and the probe type jumpers. Port 1 bits 1, 2, and 3, sense the matrix outputs, which are active high for any true condition. R1, R2, and R3, are pulldown resistors. The antitheft switch is a magnetic reed switch which senses that the instrument is in its home base. E1 and E2 are option jumpers that select the antitheft time duration. The probe connectors are jumpered such that the instrument distinguishes between a predictive type or a monitor type probe, or an empty probe connector. The matrix is basically a 4 input by 3 output arrangement with one unused intersection.

3.7 Timer Switch

The timer switch is sensed by port 6 bit 3. Actuation is active high, with debouncing done in software. This switch is not included in the function matrix, but has its own dedicated I/O bit because latency in sensing status changes via the function matrix adds unacceptable timing errors.

3.8 Reverse Polarity Protection

Protection against reversed battery installation is provided mechanically in the design of the battery holder.

3.9 Battery Monitor

A sample of the battery voltage level is monitored by the uPD7503 via bit 7 of the multiplexer U2 and the integrator circuit. When the battery voltage reaches $3.45V \pm 0.15$, a BATTERY LOW message will be displayed, indicating the batteries are low and will soon need replacing. If the battery voltage continues to decrease to $3.15V \pm 0.15$, the BATTERY LOW message will be replaced by a REPLACE BATTERY message, indicating the batteries are unusable and must be replaced.

3.10 Analog Power Control

The analog circuits are energized only when needed to minimize battery drain. Q6 is a saturated switch which applies power to the analog circuits. Q6 is enabled by an active low at port 5 bit 1.

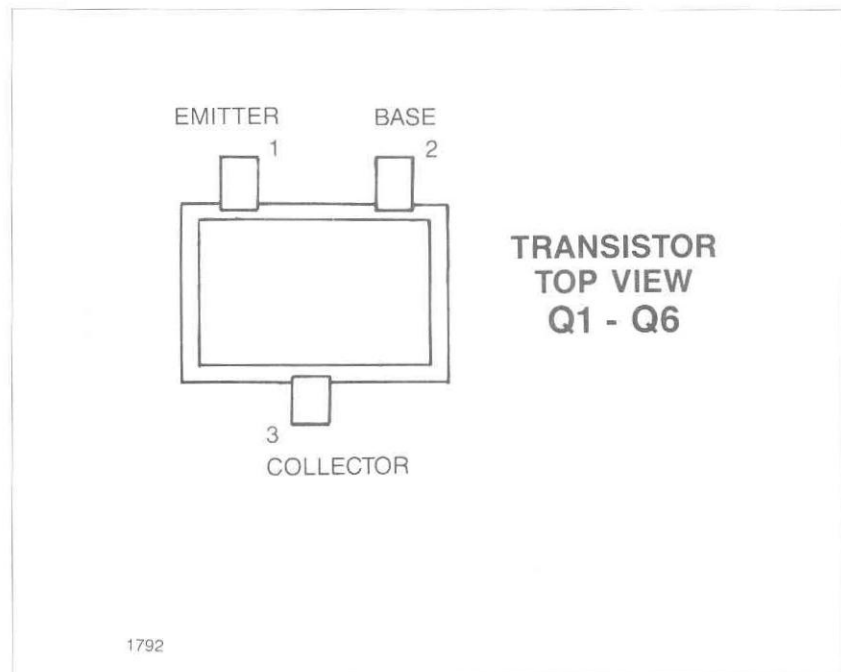
3.11 Beeper Oscillator

An astable multi-vibrator consisting of part of U6 and C17-R23-R24, drives a piezoelectric audio transducer, LS1, at approximately 850 Hz. It is enabled by an active low at port 5 bit 3.

3.12 LCD Bias Network

The LCD bias network is a voltage divider (R17, R18, R20 and R21) which provides three bias levels to the LCD driver in the microcomputer (VLCD1, VLCD2, and VLCD3). The voltage across this divider is controlled by the base-emitter turn-on threshold of Q1 (see Figure 3-3 for configuration). When Q1 begins to conduct, Q2 also conducts, tending to keep the voltage across the divider fixed. R19 absorbs any difference between the total divider voltage and total supply voltage. Additionally, the temperature coefficient of Q1's base-emitter junction results in temperature compensation of the LCD bias voltages. The bias network is enabled by an active logic low and disabled by an active logic high at port 3, bit 3. Disabling the bias network when the display is not needed reduces battery drain. Regulation of the LCD bias voltages by Q1 and Q2 is necessary as a simple divider cannot maintain the required bias voltages over the instrument's operating range.

Figure 3-3. Transistor Configuration



3.13 Backlight Oscillator

The electro-luminescent backlight for the display is energized by a DC to AC converter consisting of T1, Q4, Q5, C19, C23 and R27 and R28. This circuit generates an approximately 200 volt peak-to-peak slow rise time square wave of approximately 200 Hz. The operating frequency is a function of the electro-luminescent lamp capacitance, C19, and the inductance and core characteristics of T1. This circuit is basically an astable multivibrator, cross-coupled via T1's primary winding. The backlight circuit is enabled via saturated switch Q3. An active logic low at port 5 bit 0 enables Q3.

3.14 I/O Definitions

3.14.1 Display (see Figure 3-4)

The display is a three level multiplexed liquid crystal display driven by an integral display driver in the uPD7503 microcomputer using a three level $\frac{1}{3}$ bias system. The refresh rate is 170.7 Hz. The minimum theoretical number of connections is three backplanes and 16 segment lines. Due to conductor layout restrictions in the display itself, the segments were brought out to 25 points, which were condensed down to 21 segment lines, leaving the equivalent of 15 non-existent segments ($3 \times 21 - 48 = 15$). The segment lines are labeled S0 through S20. The backplane lines are labeled COM0, COM1, and COM2.

3.14.2 I/O Ports

The uPD7503 is configured in the Model 2080 as follows:

Port 0/Serial Port:	Serial output for testing and data acquisition (SCK) and SO
Port 1/INT0:	Interrupt 0 and input port bits 1,2 and 3 (not in uPD7503)
Port 2:	
Port 3:	Output port, bits 0 through 3
Port 4:	Output port, bits 0 through 3
Port 5:	Output port, bits 0 through 3
Port 6:	Input port, bits 0,1 and 3 Output port, bit 2

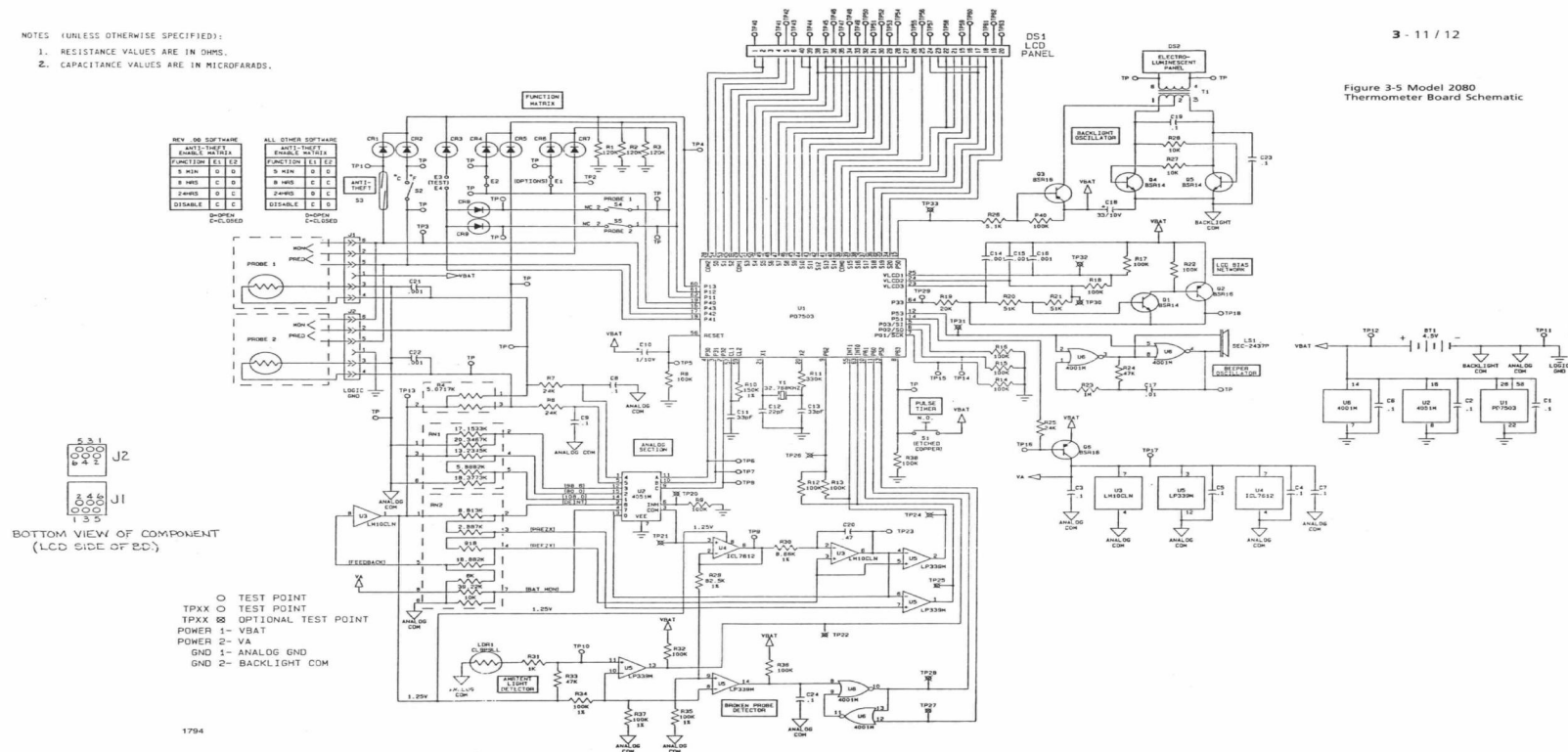
Figure 3-4.
LCD Pin Assignment

LCD PIN ASSIGNMENT			
LCD PIN	BP1	BP2	BP3
1			BP3
2			BP3
3	---	---	---
4	---	BOTH PROBES OUT	REPLACE BATT.
5	---	BROKEN PROBE	RETURN TO BASE
6	---	BATTERY LOW	FIX ME
7	(NO PIN)		
8	(NO PIN)		
9	(NO PIN)		
10	(NO PIN)		
11	(NO PIN)		
12	(NO PIN)		
13	(NO PIN)		
14	(NO PIN)		
15	BAR 10	---	BAR 9
16	BAR 11	---	BAR 8
17	---	---	BAR 7
18	---	---	BAR 6
19	BAR 2	---	BAR 5
20	BAR 3	---	BAR 4
21	BP1		
22	BP1		
23	BAR 1	---	---
24	BAR 12	---	---
25			
26	---	BAR "C"	---
27		BAR "F"	---
28	1B	1C	---
29	1A	1G	1D
30	1F	1E	---
31	2B	2C	DP
32	2A	2G	2D
33	2F	2E	---
34	3B	3C	---
35	3A	3G	3D
36	3F	3E	---
37	---	---	4B, 4C
38	---	---	MONITOR MODE
39		BP2	
40		BP2	

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1. RESISTANCE VALUES ARE IN OHMS.
2. CAPACITANCE VALUES ARE IN MICROFARADS.

Figure 3-5 Model 2080
Thermometer Board Schematic



Chapter Four ***Troubleshooting***

4.0	Introduction.....	4 - 1
4.1	Self - Test Routine.....	4 - 1

4.0 INTRODUCTION

This chapter provides assistance in troubleshooting the TEMP•PLUS II Thermometer should repair be necessary. Referring to this chapter before attempting to service, repair or replace any component will save time and may avoid unnecessary repair.

Should a problem occur, first ensure:

- a. That the instrument is being operated correctly
- b. That the batteries do not need replacing
- c. That the batteries are properly installed
- d. That the antitheft timer has not timed-out, requiring it to be reset.

4.1 Self-Test Routine

The TEMP•PLUS II Thermometer performs self-diagnostic tests each time the instrument is used to take a temperature measurement and each time the batteries are replaced. Should the instrument detect an alarm condition, the appropriate message will flash in the display, accompanied by three long beeps, and the instrument will cease to function. Tables 4-1 and 4-2 list probable causes and remedies for various alarm messages and problems.

Table 4-1. Alarm Summary

PROBLEM / ALARM	REMEDY
FIX ME 1	ROM test error.
FIX ME 2	RAM test error.
FIX ME 4	Analog or calibrate error.
BATTERY LOW	Batteries are wearing out and need replacing.
REPLACE BATTERY	Batteries are unusable and must be replaced.
RETURN TO BASE	If displayed continuously, there is less than one hour remaining on the predetermined antitheft timer, and the instrument needs to be returned to the home base to be reset.
	If the message is flashing, the antitheft time period has expired. The instrument will not function until it is returned to the home base and reset.
BROKEN PROBE	Indicated probe (1 or 2) needs to be replaced.
BOTH PROBES OUT	Return one probe to storage well or disconnect one probe from instrument. The instrument will not function with both probes withdrawn.

Table 4-2. Operational Troubleshooting Guide

PROBLEM	PROBABLE CAUSE	SOLUTION
Instrument completely inoperative - no display and no audible signal. No power present on board.	Batteries dead.	Replace batteries.
	Bad contact in battery holder.	Ensure batteries are engaging the contacts. Ensure the battery contacts are properly mated with the contacts on the PC board. This requires opening up entire instrument.
	Shorted bypass capacitor C1, C2, C6, or C18.	Use ohmmeter to test for short. Replace shorted capacitor.
Instrument completely inoperative - no display and no audible signal. Power is present on board.	Microcomputer being held reset or not resetting.	Verify integrity of R8 from U1-56 to U1-22. Check for open or shorted C10. Replace R8 or C10 if defective.
	No timebase clock.	Check for 32.768 kHz waveform at U1-20. If not present, Y1, R11, C12 or C13, or U1 are defective. Replace Y1 first if R11, C12, and C13 are good, then replace U1.
	No processor clock.	Check for approximate 100 kHz waveform at U1-59 (may be chopped at low rate). If not present (check for timebase clock (above), or R10, C11 or U1 are defective. Replace U1 if R10 and C11 are good.
Instrument begins power-on test sequence apparently spontaneously during operation.	Intermittent battery contact.	*Check for damage and proper fit of battery contacts against cells and PC board. To check contact against PC board, open up instrument.
Instrument alarms FIX ME 1 or FIX ME 2 during operation.	Intermittent battery contact.	*Check for damage and proper fit of battery contacts against cells and PC board. <i>*NOTE: Individual cells may become internally intermittent and display symptoms of poor contacts in the battery holder.</i>

PROBLEM	PROBABLE CAUSE	SOLUTION
Apparent short battery life.	High backlight usage.	Check for correct backlight operation (see pages 4-5 and 4-6).
	Short in battery holder.	Ensure that the cells are not being shorted at the (+) end by distorted or improperly installed contacts. (A warm cell is an indication of a short.)
	Analog circuitry not being turned off when idle (Q6 always on).	Check for shorted Q6 or U1-14 stuck at logic 0. Q6 collector should have no voltage when the instrument is idle.
	Using old batteries.	Use fresh batteries that have not been subject to long storage.
FIX ME 1 indication upon battery installation.	Microcomputer internal memory test failure.	Defective U-1. Replace U1.
	Improper power-on reset when replacing batteries.	Check R8 and C10. Replace if defective.
FIX ME 2 indication upon battery installation.	Microcomputer internal RAM test failure.	Defective U1. Replace U1.
	Improper power-on reset when replacing batteries.	Check R8 and C10. Replace if defective.
FIX ME 4 indication at conclusion of power-on self-testing.	Analog circuitry not turning on due to defective Q6, R25, U1 or shorted C3, C5, C4, C7, U3, U5, or U4.	Check for shorts and replace shorted components.
		Connect Q6 base to battery (-) via a 10K Ω resistor and determine if analog supply voltage is approximately equal to battery (+) voltage.
		Check that U1-14 goes to logic 0 toward end of power-on self-testing for approximately 2 to 3 seconds to turn the analog supply voltage on.
	No 1.25 volt reference voltage due to defective U3 or RN2.	Check for 1.19 to 1.31 volts at U3-1 when analog voltage is on.
	RN1 or RN2 out of tolerance.(See table 4-3)	Remove RN1 and RN2 carefully and measure with an accurate bridge. RN1 must be $\pm .05\%$ and RN2 must be $\pm 0.1\%$. Note that there are

(continued on next page)

PROBLEM (continued)

FIX ME 4 indication at conclusion of power-on self-testing.

PROBABLE CAUSE

SOLUTION

two different versions of RN2 - earlier units should measure 9000 Ω between pins 1 and 2 and 2700 Ω between pins 2 and 3, and later units should measure 8813 Ω between pins 1 and 2 and 2887 Ω between pins 2 and 3.

Defective U2, R9, or U1.

Look for voltage steps that lie in the range of approximately 0.6 to 0.95 volts at U2-3 sometime during the time the backlight is energized toward the end of power-on self-test. If the voltage steps are absent check for changing logic levels at U2-9, 10 and 11 from U1-2,3 and 4 at the same time the voltage steps were expected. If U2-3 appears to be floating check that U2-6 is 100K Ω to ground (thru R9).

Defective U4.

Short Q6 emitter to collector to enable analog circuitry and compare U4-6 to U4-3. U4-6 must track within ± 7 millivolts of U4-3.

Defective U3 (op amp section), R30 or C20.

Check for ramp waveforms at U3-6 at the time voltage steps are present at U4-6 (from U2-3) toward the end of power-on self-test. If U3-6 swings between ground and supply voltage, C20 or R30 may be defective. If U3-6 does not change, C20, U3 or R30 may be defective.

U3-2 and U3-3 should be within 2 millivolts of each other with Q6's emitter and collector shorted together. If not, U3 may be defective.

Instrument occasionally gives a FIX ME 4 indication.

Intermittent battery contacts.

Check integrity of battery contacts or try new batteries.

Resistor network out of tolerance.

Check RN1 and RN2 as described above.

Intermittent connection in analog section.

Check solder joints and surface mounted components for cracks or other damage.

PC board leakage.

Check for contamination on PC board. Clean if necessary.

Noisy 1.25 volt reference.

Check 1.25 volt reference for sudden "jumps" in voltage. If present, U3 may be defective.

Leakages in U2.

Replace U2.

(continued on next page)

PROBLEM (continued)	PROBABLE CAUSE	SOLUTION
Instrument occasionally gives a FIX ME 4 indication.	Excessive offset in U4.	Check U4 as described.
	R30 or C20 values out of range.	R30 should be $8.66K \Omega \pm 1.0\%$. C20 should be $0.47 \mu f \pm 5\%$ with no less than 50 meg Ω of leakage resistance.
REPLACE BATTERY message with known new good batteries (software revision 0.00 only - early units).	Offset in U4.	Check U4 as described above. Offset voltage as measured from U4-6 to U4-3 should be within 0 to -7 millivolts. If unit has $1K \Omega$ resistor added between U4-1 and RN2-8 check connections.
Instrument "hangs up" at end of self-tests or during operation.	Defective U5 or R12, or R13 not allowing interrupt in U1.	Check for low to high logic level transitions at U5-1 and U5-2. U5-1 should precede U5-2 by about 1 millisecond. U1-9 should be logic high part of the time when instrument is active.
Display has missing or faint segments.	Poor contact through elastomeric connectors to PC board.	Clean connections.
	Broken display glass.	Replace display glass.
	U1 defective.	Replace U1.
Display has all segments equally faint or non-activated segments appear faintly.	Improper display drive voltage.	With display active measure from: U1-26 to U1-25 U1-25 to U1-24 U1-24 to U1-23 Each should be approximately 0.95 to 1.0 volt. If all are high but equal, check Q1 and Q2. If all are low but equal check R20 or R19. If there are large variations check Q1, R17, R18, R20, R21, C14, C15 and C16.
	PC board leakage or contamination.	Clean PC board.
	U1 defective.	Replace U1.
	U5, R31, R33, R34, R32 or R37 defective.	With Q6 emitter-collector shorted to apply analog power check to see that U5-13 is logic high in the dark and logic low in room light. U5-10 should be one-half the actual level of the 1.25 volt reference (R34-R37 junction).
Backlight inoperative.	LDR1 (light sensor) defective.	Measure resistance of LDR1: in the dark, it should be greater than $100K \Omega$, in bright room light it should measure less than 2000Ω .

(continued on next page)

PROBLEM (continued)

PROBLEM	PROBABLE CAUSE	SOLUTION
Backlight Inoperative	Backlight oscillator not operating - Q3 or R26 defective.	Connect Q3 base to battery (-) via a 4.7K Ω resistor to activate circuit. If circuit operates (approximately 200V peak-peak 200 Hz waveform at T1 secondary), U1 is not actuating Q3 (R26 or U1 defective).
	Backlight oscillator not operating - Q4, Q5, C23, C19, T1 defective.	Check for shorted Q4 or Q5 (oscillator will operate with Q4 or Q5, or R27 or R28 open, but at reduced efficiency). Check for shorted C19 or C23 or open T1 primary.
	Backlight oscillator operates (approximately 200 Hz waveform at Q4-Q5 collectors). No connection from transformer T1 secondary to backlight due to open secondary or bad connection at elastomeric connector.	Replace T1 if secondary open. Normal DC resistance is about 1000 Ω . Clean and reposition elastomeric connector if poor contact.
Backlight seems to operate excessively.	Defective LDR1 (light sensor).	Replace LDR1.
	Light access hole blocked, out of position, or dirty.	Clear access hole and ensure that LDR1 is under hole. Remove contamination from LDR1.
	R37 or R34 defective.	Check U5-10. This should be one-half the 1.25 volt reference voltage level.
	R33 defective.	Replace R33.
Backlight does not turn off.	Shorted Q3, defective U1.	Check Q3 for shorted collector-emitter and replace if necessary. If U1-15 is always logic low, U1 is defective.
Beeper inoperative.	Defective LS1, U6, C17, R23 or R24, or U1.	Check for approximately 800 to 1000 Hz square wave at U6-4 when beep is expected. If present, replace LS1. If no square wave is present check for logic low at U1-12 (U6-5) when beep is expected. If not present U1 is defective, otherwise U6 or R23 or R24 or C17 are defective.
Beeper operates continuously.	Defective U1.	Replace U1.

PROBLEM

No beeps at end of temperature cycle.

PROBABLE CAUSE

Instrument entered monitor mode due to high initial probe temperature.

SOLUTION

Cool probe tip prior to taking temperature.

RETURN TO BASE does not reset.

Weak magnet in home base.

Try another home base.

Defective S3 or CR1.

Apply magnet to test S3 closure. If S3 closes, replace CR1.

Defective U1.

Replace U1 if S3 and CR1 functional.

In instruments with rev. 0.00 or 0.01 software - defective CR4 or CR6 or E1 or E2 jumper causing 5 minute time-out mode.

Replace CR4 or CR6 as required or missing E1 or E2 jumper.

RETURN TO BASE message appears a few minutes after resetting in home base.

In instruments with software revision above 0.01 - defective CR4 or CR6 or E1 or E2 jumper causing 5 minute time-out mode.

Replace CR4 or CR6 or E1 or E2 jumper, as required.

E1 (CR6)	Antitheft time-out		
	E2 (CR4)	Rev. 0.00	Rev. 0.01 and above
Open	Open	5 minutes	5 minutes
Closed	Open	8 hours	Disabled
Open	Closed	24 hours	24 hours
Closed	Closed	Disabled	8 hours

RETURN TO BASE never appears or appears at the wrong time, i.e., 24 hours instead of 8 hours.
(NOTE: RETURN TO BASE will not appear if the instrument is normally stored in it's base.)

Defective CR4 or CR6 or jumper E1 or E2.

Replace CR4 or CR6 or E1 or E2 jumper, as required.

Instrument indicates broken probe, but probes are known to be good.

Defective R34, R37, R36, R35, U5 or U6, or U1, or RN2.

Check for between 0.6 to 0.95 volts at RN2-7. If high, replace RN2. Check for approximately one-half the actual 1.25 volt reference voltage at U5-8. If not correct R34 or R37 or possible U5 is defective. Check U5-9 for approximately 55% of the voltage at U4-6.

(continued on next page)

PROBLEM (continued)

Instrument indicates broken probe, but probes are known to be good.

PROBABLE CAUSE

SOLUTION

If not correct R29 or R35 or possibly U5 is defective. Check for a logic low level with no high pulses with an oscilloscope at U5-14. If not correct R36 or U5 is defective. Check for a logic high at U6-10 and a logic low at U6-11 with U6-8 at a logic low. If not correct, U6 or U1 may possibly be defective.

Probe tip temperature below 35°F (1.67°C)

Keep instrument and probes within specified operating temperatures.

Temperature does not rise.

Open probe with instrument unable to detect broken probe (defective R34, R37, R29, R35, U5 or U6).

Check for approximately one-half the actual 1.25 volt reference voltage at U5-8. If not correct R34 or R37 or possible U5 is defective. Check U5-9 for approximately 55% of the voltage at U4-6. If not correct R29 or R35 or possible U5 is defective.

Short R37 and check U5-14 for a logic low to logic high transition. If not present U5 is defective. If correct, check U6-10 for a logic low and U6-11 for a logic high. If not correct U6 is defective, otherwise U1 is defective.

Measured temperature below minimum temperature range of instrument.

Use alternate method to check patient's temperature.

Instrument indicates very high or full scale (108°F/42.2°C) temperatures.

Defective probe.

Replace probe.

R4 Defective.

Check R4 (dual resistor) by carefully removing and using a bridge to measure from the center terminal to each side. Each side should be $5071.7 \Omega \pm .009\%$. Replace if not correct.

Leaky C8, C9, C21 or C22.

Replace as required.

Leakage caused by contamination on PC board.

Clean PC board.

Out of specification readings in monitor mode using water bath.

Defective probe.

Replace probe.

R4 defective.

See above procedure.

Electrical leakages.

See above procedure.

PROBLEM	PROBABLE CAUSE	SOLUTION
Pulse Timer inoperative or difficult to activate.	Contaminated contacts.	Clean contacts on PC board and inside of button.
	Antitheft system timed-out.	Reset instrument in home base.
	Defective R38 or U1.	Replace R38, then U1.
Memory recall did not work.	Pulse timer button inoperative.	Replace R38, then U1.
	Last temperature not a completed predictive temperature.	Ensure temperatures are not monitor mode and are completed before returning probe to well.
	Defective S4 or S5.	Replace S4 or S5, as required.
Withdrawing probe from one well does not actuate instrument.	Defective CR8 or CR9.	Replace CR8 or CR9, as required.
	S4 or S5's lever interferes mechanically in probe well.	Correct mechanical interference as necessary.
	Defective jumper in probe connector.	Replace probe.
One probe connector does not function with known good probe, either predict or monitor.	Only one probe plugged into instrument.	Both probe wells must be empty in order for instrument to operate.
	CR5 or CR7 defective.	Replace CR5 (probe 2) or CR7 (probe 1), as required.
	S2 or CR2 defective.	Replace S2 or CR2, as required.
Celcius range cannot be selected.	S2 defective.	Replace S2.
Fahrenheit range cannot be selected.		

Table 4-3. Resistance Table

RN1 Resistance Table ($\pm 0.05\%$)			RN2 Resistance Table ($\pm 0.10\%$)		
PINS			PINS		
1 - 2	20346.7 Ω		1 - 2	8813 Ω	(9000 Ω)*
2 - 3	17153.3 Ω		2 - 3	2887 Ω	(2700 Ω)*
3 - 4	13234.5 Ω		3 - 4	918 Ω	
4 - 5	5888.2 Ω		4 - 5	18882 Ω	
5 - 6	18377.3 Ω		5 - 6	6000 Ω	
			6 - 7	10000 Ω	
			7 - 8	39220 Ω	

*RN2 P/N 121839NC

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5.3.1	TE1137 Test Fixture.....	5 - 3
5.3.2	Resistance Decade.....	5 - 3

5.0 INTRODUCTION

This section contains those procedures required to properly disassemble, repair, replace, test, and assemble the TEMP•PLUS II - Model 2080 Thermometer. This section includes a list of tools or test equipment required to perform these functions.

NOTE

A thorough familiarization with the function and operation of the circuits in the Model 2080 will facilitate repair and replacement. Refer to Chapter 3 for a functional description and Chapter 4 for troubleshooting information.

Table 5-1 contains a list of tools and equipment required for normal maintenance of the TEMP•PLUS II unit.

5.1 Disassembly

The TEMP•PLUS II unit consists of solid state electronic components packaged in a compact case. Figure 5-1 shows the internal location of the major subassemblies and their fasteners. Visual observation alone will not necessarily reveal the correct order of disassembly. For this reason, IVAC recommends that the following disassembly procedures be performed in the sequence described.

- a. Remove probe cover container.
- b. Unplug probes and remove them from the instrument.
- c. Using a coin, pop open the battery compartment and remove the batteries.
- d. Remove the two screws (figure 6-1, item 6) at the top rear of the instrument and the screw (item 7) accessible through the battery compartment. To access the screw in the battery compartment it is necessary to remove the upper battery contact pad (figure 6-4, item 7).
- e. Lift the back case half off the instrument with the battery holder, exposing the PC board, which will still be attached to the front case half.

Figure 5-1. Accessing the TEMP•PLUS II Thermometer.

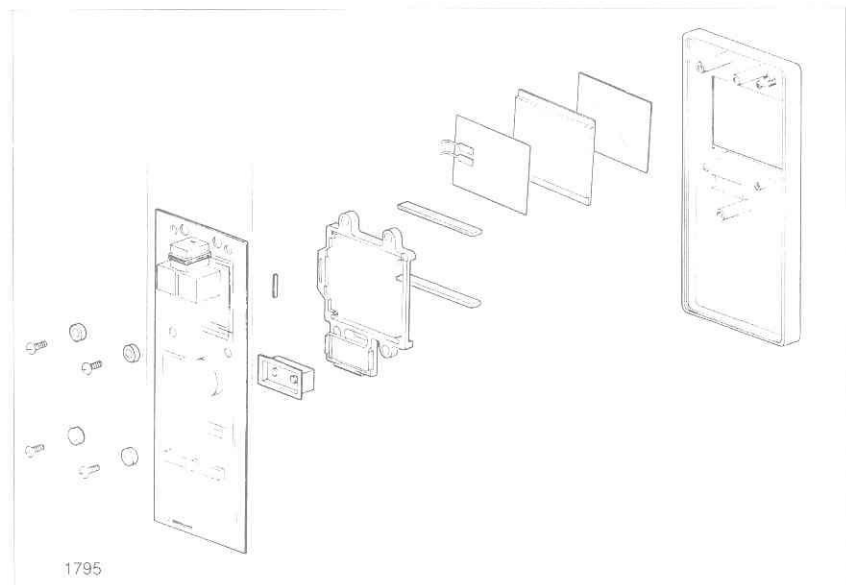


TABLE 5-1. Test Equipment and Tools

NAME	MANUFACTURER / MODEL NUMBER
Digital VOM	Beckman 2020 or equivalent
Oscilloscope	20 MHz vertical bandwidth, 50 mV to 50 V/Division vertical sensitivity
Circulating Water Bath	Bronwill, Model 1420M
Resistance Substitution Box	ESI DB877 or equivalent, or IVAC TE1137 Test Fixture.
Resistance Bridge	At least 0.001% accuracy
Low Temperature	400 to 500°F (204 to 260°C)
Soldering Iron	
Phillips screwdriver	#1 bit
Soldering/Desoldering Station	Plato Hot Grips, V125
Tweezers	Linstrom, AC
Soldering Flux Liquid	Kester RA Type, 1544

The option jumpers (E1 and E2) and major components are now accessible. Further disassembly is not recommended unless it is necessary to gain access to the display or other components on the front side of the PC board.

- f. To remove the PC board from the front case half, remove the four screws with plastic collars (figure 6-2, item 11).
- g. Gently rock the PC board loose from the case front. There are elastomeric connectors between the display and the PC board which should be carefully separated from the PC board and allowed to remain in the case front with the display frame (figure 6-2, item 3) and PULSE TIMER button.

NOTE

Do not remove the display frame with the display, backlight, and elastomeric connectors unless it is necessary to replace the display.

CAUTION

Avoid contaminating the display connection pads and PULSE TIMER button contacts by handling or contacting with any type of foreign matter. Before reassembly, the contacts may be cleaned with isopropyl alcohol.

- h. Using a small screwdriver, gently pry the display frame off the front case. The display, backlight, pulse timer button, and elastomeric connectors can now be removed, if necessary, for replacement.

5.2 Reassembly (refer to figure 5-1)

- a. Reverse the order of disassembly listed previously. Ensure that the display glass is properly seated in the display frame and that the elastomeric connectors are in the proper position before tightening the screws and collars.

CAUTION

Failure to properly seat the display frame could cause the display to crack when securing the PC board to the front panel. Avoid over-tightening the screws as it may damage the display.

- b. Restart instrument and observe display while instrument runs through self-test. Perform calibration verification (see section 5.3).

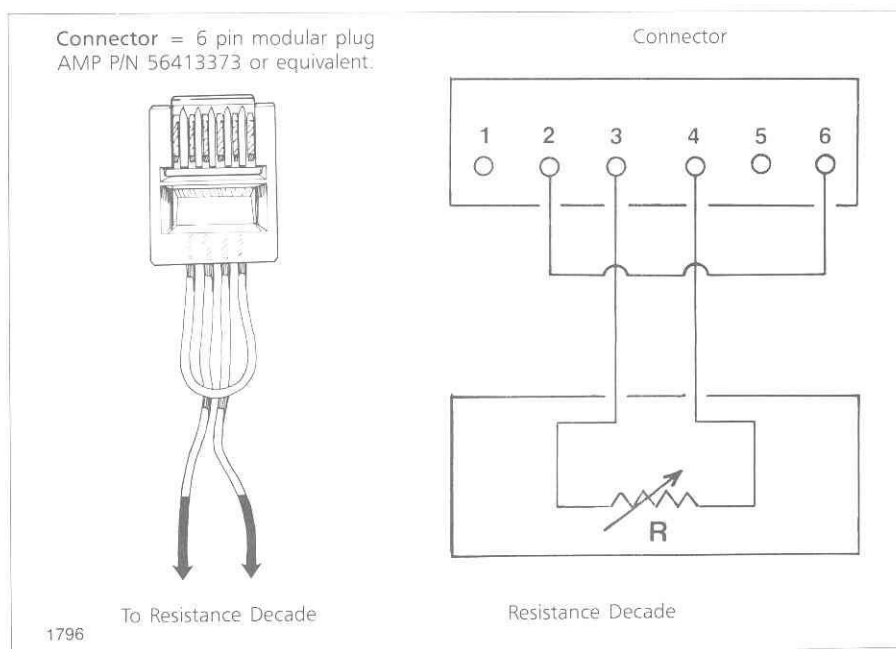
5.3 Calibration Verification**5.3.1 Using the TE1137 Test Fixture perform the following:**

- a. Connect the test fixture to probe connector 1 and verify that the MONITOR MODE message is displayed and the instrument emits two short beeps.
- b. Rotate the temperature selector to each range and verify that the displayed value is as follows:
 - 80.2 $\pm 0.2^{\circ}\text{F}$ (26.7 $\pm 0.1^{\circ}\text{C}$)
 - 98.0 $\pm 0.1^{\circ}\text{F}$ (36.7 $\pm 0.1^{\circ}\text{C}$)
 - 98.6 $\pm 0.1^{\circ}\text{F}$ (37.0 $\pm 0.1^{\circ}\text{C}$)
 - 102.0 $\pm 0.1^{\circ}\text{F}$ (38.9 $\pm 0.1^{\circ}\text{C}$)
 - 107.8 $\pm 0.2^{\circ}\text{F}$ (42.1 $\pm 0.1^{\circ}\text{C}$)
- c. Rotate the temperature selector to the broken probe position and actuate the broken probe button for at least 1 second. The message BROKEN PROBE should appear in the display.
- d. Connect the test fixture to probe connector 2 and repeat steps a through c.

5.3.2 Using the resistance decade (alternative to 5.3.1):

- a. Connect the resistance decade as shown in figure 5-2.

Figure 5-2. Resistance Decade



Corrective Maintenance

- b. Connect the fixture to probe connector 1 and verify that the MONITOR MODE message is displayed and the instrument emits two short beeps.
- c. Verify that the temperature values shown are displayed for each given resistance setting of the resistance decade:

9254.3 Ω	:	82.0 $\pm 0.2^{\circ}\text{F}$	(27.8 $\pm 0.1^{\circ}\text{C}$)
6098.6 Ω	:	98.0 $\pm 0.1^{\circ}\text{F}$	(36.7 $\pm 0.1^{\circ}\text{C}$)
6015.9 Ω	:	98.6 $\pm 0.1^{\circ}\text{F}$	(37.0 $\pm 0.1^{\circ}\text{C}$)
5570.9 Ω	:	102.0 $\pm 0.1^{\circ}\text{F}$	(38.9 $\pm 0.1^{\circ}\text{C}$)
4895.6 Ω	:	107.8 $\pm 0.2^{\circ}\text{F}$	(42.1 $\pm 0.1^{\circ}\text{C}$)

- d. Set the resistance decade to a value greater than 1 megohm and verify that the message BROKEN PROBE appears in the display.
- e. Connect the fixture to probe connector 2 and repeat steps b through d.

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6.0 INTRODUCTION

The illustrated parts breakdown for the IVAC TEMP•PLUS II Thermometer - Model 2080, consists of the complete system divided into assemblies, subassemblies and component parts.

6.1 Illustrations

The following paragraphs describe exploded view and board assembly illustrations.

6.1.1 Exploded View Illustrations

Exploded view illustrations serve as visual aids for identifying the component parts of each assembly. Index numbers used on the illustrations, when used in conjunction with the appropriate parts list, identify each part shown.

6.1.2 Board Assembly Illustrations

Board assembly drawings illustrate the board layout, identifying the location of each component. The accompanying parts list describes each component in detail.

6.2 Parts List

The parts list provides part numbers and descriptions of every part/subassembly which is identified on the drawings, and which may require replacement when the instrument is serviced or repaired. In the case of electronic components on the PW board, reference designations are supplied, rather than index numbers, as an aid to locating the component in the circuit (PW boards are not depicted as exploded views). Paragraphs 6.2.1 — 6.2.5 explain the contents of the parts list in further detail.

6.2.1 Fig./Index Number

This column lists the numbers of the figure referenced by the parts list, and provides index numbers of assemblies/components identified on the drawing. The index numbers on an illustration correspond to the same number appearing on the parts list.

6.2.2 Part Number

The number appearing in this column is an IVAC-assigned part number in one of two categories:

- a. IVAC designed and built: 100000 series numbers
- b. IVAC procured but built by (and available from) an outside vendor: 300000 series numbers

All 300000 series numbers may be purchased either from IVAC or from the

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original manufacturer/distributor. Upon request, IVAC will supply the manufacturer's name and part number.

6.2.3 Description

This column of the parts list provides descriptive data (type, size, color, etc.) required to identify the part when ordering or replacing it. Abbreviations used are defined in Table 1-2.

6.2.4 Qty.

This column indicates the total number of each part used within the assembly.

6.2.5 Ref Des

Each electronic component assigned a circuit symbol has that designation listed in this column. Used in conjunction with the schematic diagram and the descriptions in the parts list, the reference designation number (which appears on the board assembly drawings to identify each component's location), provides data required to troubleshoot or repair/replace any component.

6.3 Ordering Parts

Parts can be ordered by writing or calling the IVAC Service Department at the following address/phone number. When requesting a part, please provide the following information:

- a. Instrument name
- b. Instrument model number
- c. The six-digit part number
- d. Description of the part as it appears in the parts list.

NOTE

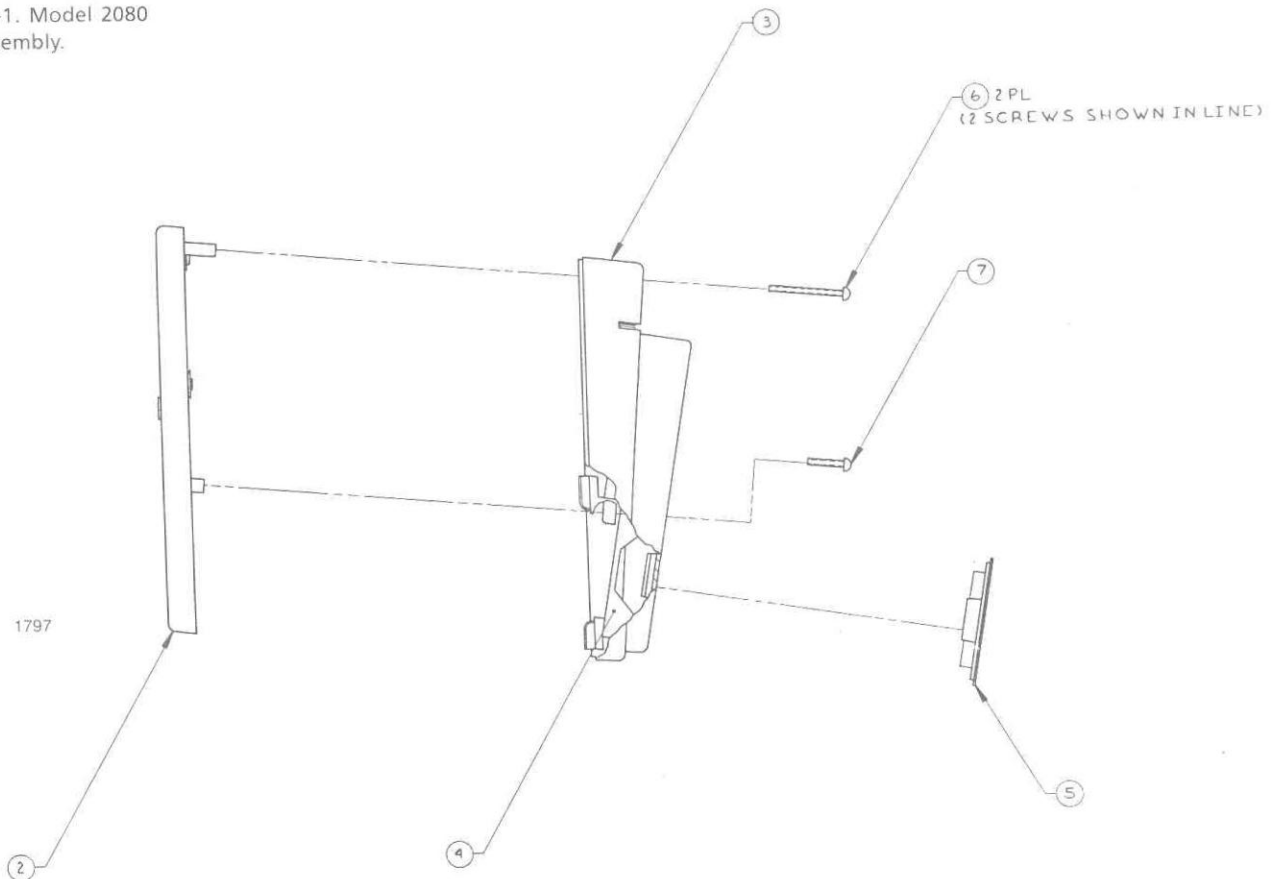
Because IVAC continues to improve the reliability of its products, the part number you receive may not match the part number you requested.

Contact:	IVAC Corporation 10300 Campus Point Drive San Diego, California 92121-1579 ATTN: Corporate Customer Service (800) 482-4822
----------	--

FIG./ INDEX NUMBER	PART NUMBER	DESCRIPTION	QTY	REF DES
6-1		TEMP•PLUS II VS MEAS SYS		
002	*	ASSY,CASE,FRONT,2080	1	
003	127392	ASSY,CASE,REAR,2080	1	
004	122907	ASSY,BATTERY HOLDER,2080	1	
005	127386	COVER,BATTERY,2080	1	
006	303610	SCREW,TPG #4-20X1.25 PNH PHL	2	
007	303469	SCREW,TPG #4-20X.625 PNH PHH	1	
008	303590	BATT,ALKALINE,SIZE AA	3	

*Parts listed without an assigned part number are not sold as individual parts.

Figure 6-1. Model 2080
Final Assembly.

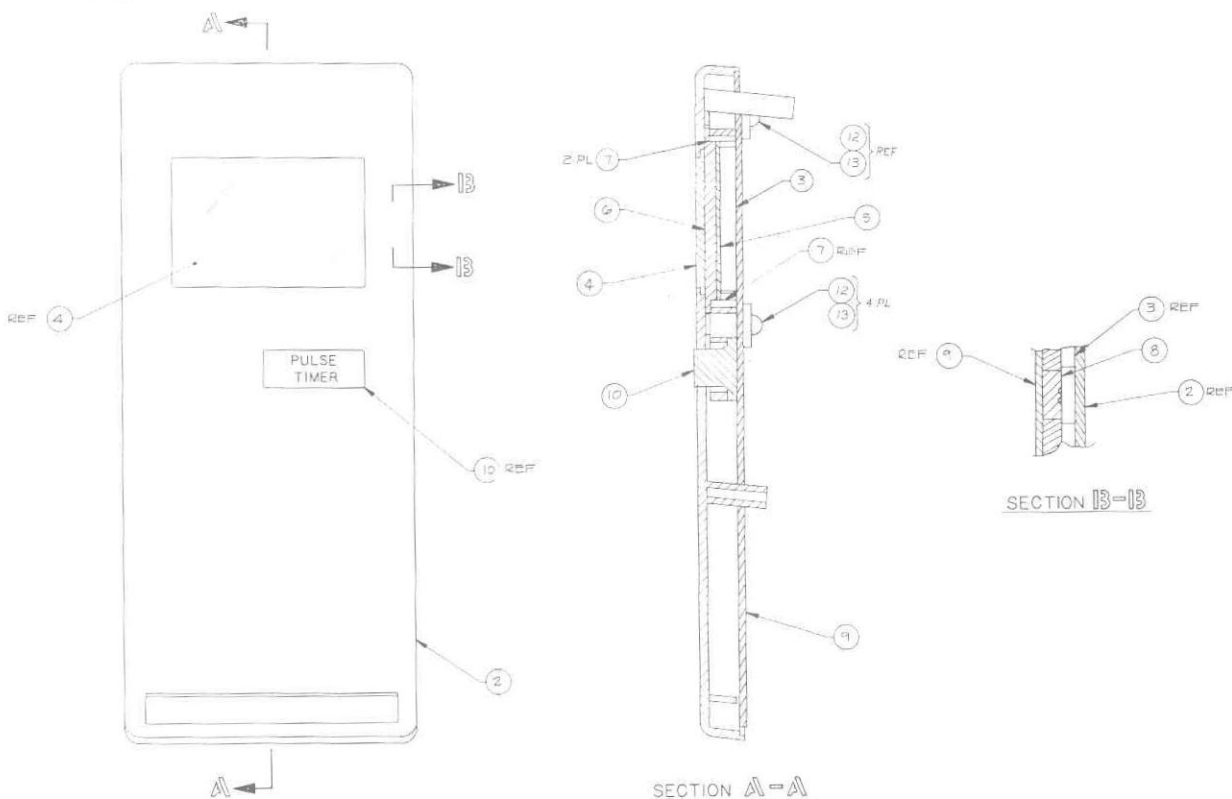


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FIG./ INDEX NUMBER	PART NUMBER	DESCRIPTION	QTY	REF DES
6-2	*	ASSY,CASE,FRONT,2080		
002	127388	CASE,FRONT,2080	1	
003	122793	FRAME,LCD,2080	1	
004	121877	LENS,2080	1	
005	121878	LAMP,LCD BACKLIGHT,2080	1	
006	127777	LCD,2080	1	
007	127113	CONTACT,LCD,2080	2	
008	127112	CONTACT,EL PANEL,2080	1	
009	121915	ASSY,THERM BD,PRGM,2080	1	
010	127130	ASSY,SW,PULSE TIMER,2080	1	
011	303570	FASTENER,RETAINING RING	4	
012	122792	WASHER,SPACER,2080	4	
013	303619	SCREW,TPG #4-20X.25 PNH PHH	4	

*Parts listed without an assigned part number are not sold as individual parts.

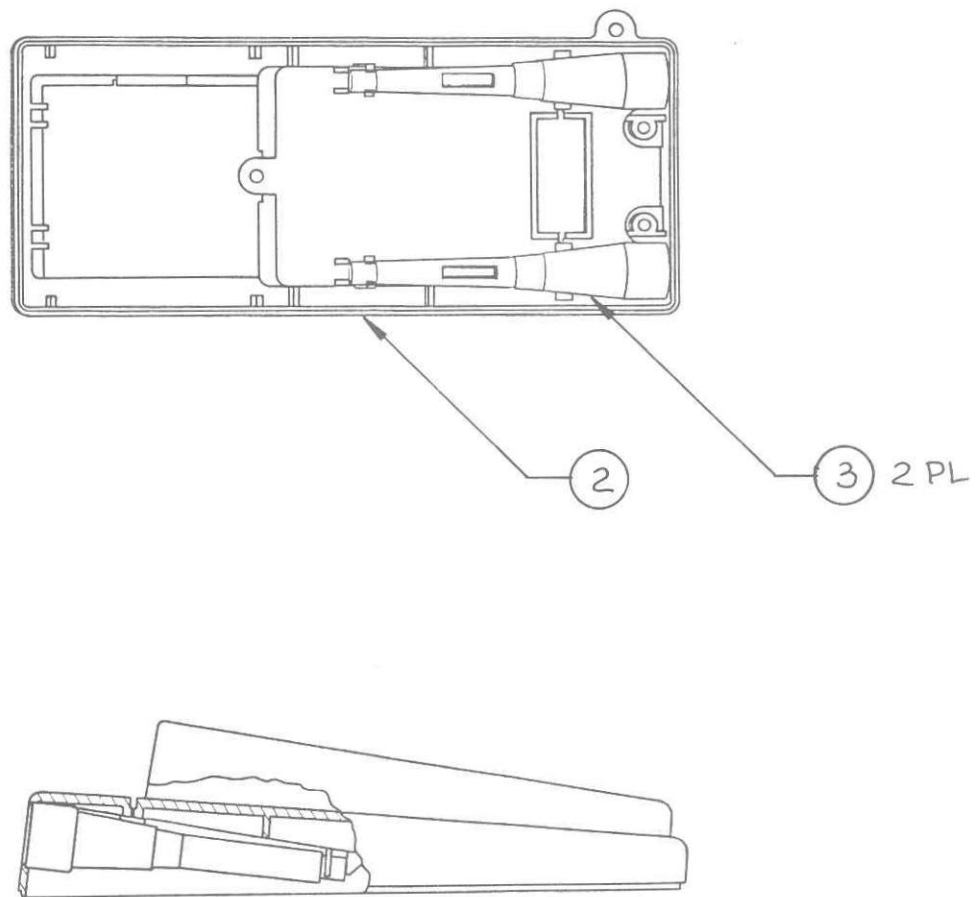
Figure 6-2. Model 2080
Front Case Assembly.



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FIG./ INDEX NUMBER	PART NUMBER	DESCRIPTION	QTY	REF DES
6-3	127392	ASSY,CASE,REAR,2080		
002	127387	CASE,REAR,2080	1	
003	127385	PROBE WELL,2080	2	

Figure 6-3. Model 2080
Rear Case Assembly.



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FIG./ INDEX NUMBER	PART NUMBER	DESCRIPTION	QTY	REF DES
6-4	122907	ASSY,BATTERY HOLDER,2080		
002	127121	HOLDER,BATTERY,2080	1	
003	127119	CONTACT,BATT,FOAM/FOIL,SM,2080	2	
004	127120	CONTACT,BATT,FOAM/FOIL,LG,2080	1	
006	127799	CONTACT,BATT,FOAM/FOIL,NG,2080	1	

Figure 6-4. Model 2080
Battery Holder Assembly.

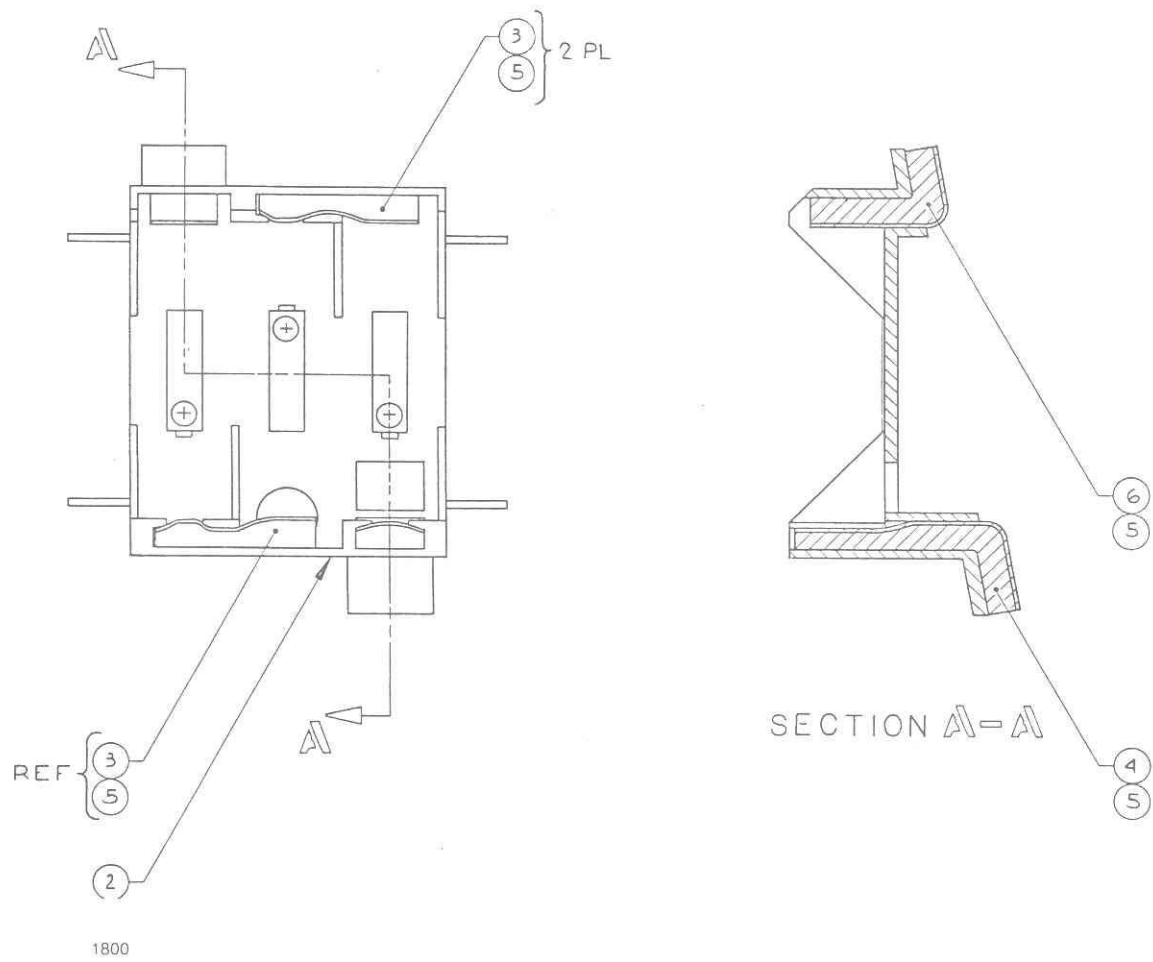
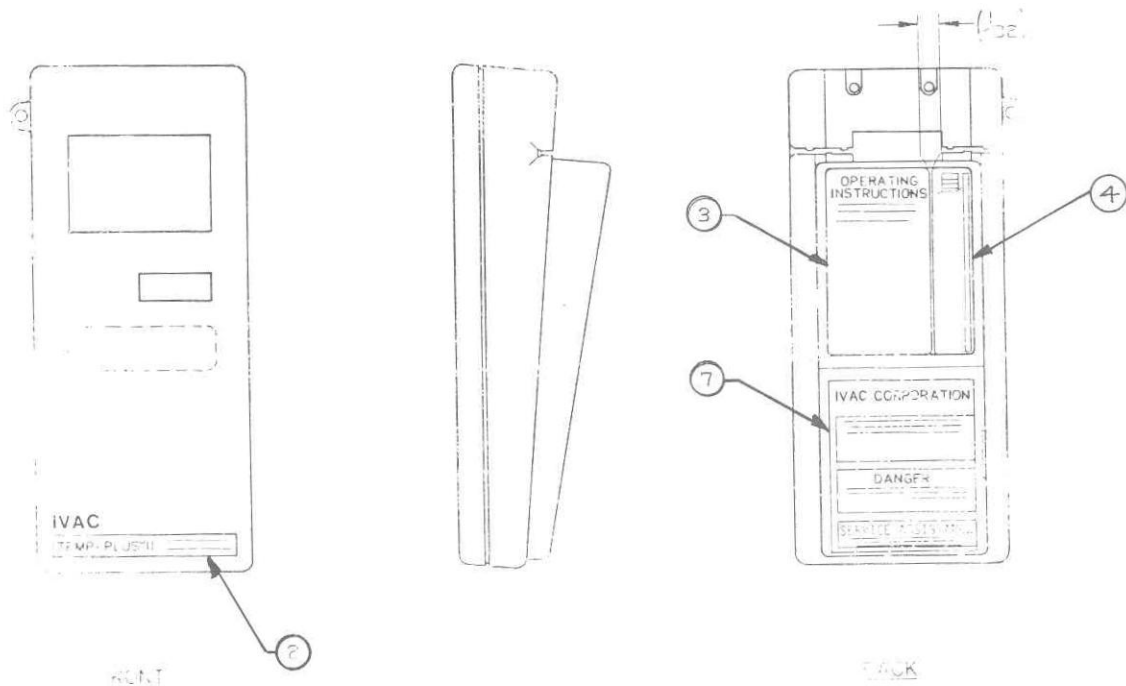


FIG./ INDEX NUMBER	PART NUMBER	DESCRIPTION	QTY	REF DES
6-5		LBL/LIT/STATUS,ENG,2080		
002	122677	LABEL,TEMP•PLUS II,2080	1	
003	127723	LABEL,OPERATING INSTD,2080	1	
004	127409	LABEL,S/N,BAR CODE,2080	1	
005	100133	CARD,CLAIM NOTICE	1	
006	127865	DFU,2080	1	
007	127382	LABEL,NAME RATING/DNG/TOLLFREE	1	
009	127945	LABEL,ANTITHEFT,ENGLISH,2080	1	
011	127946	CARD,ACCESSORY PLCMT INSTD,2080	1	

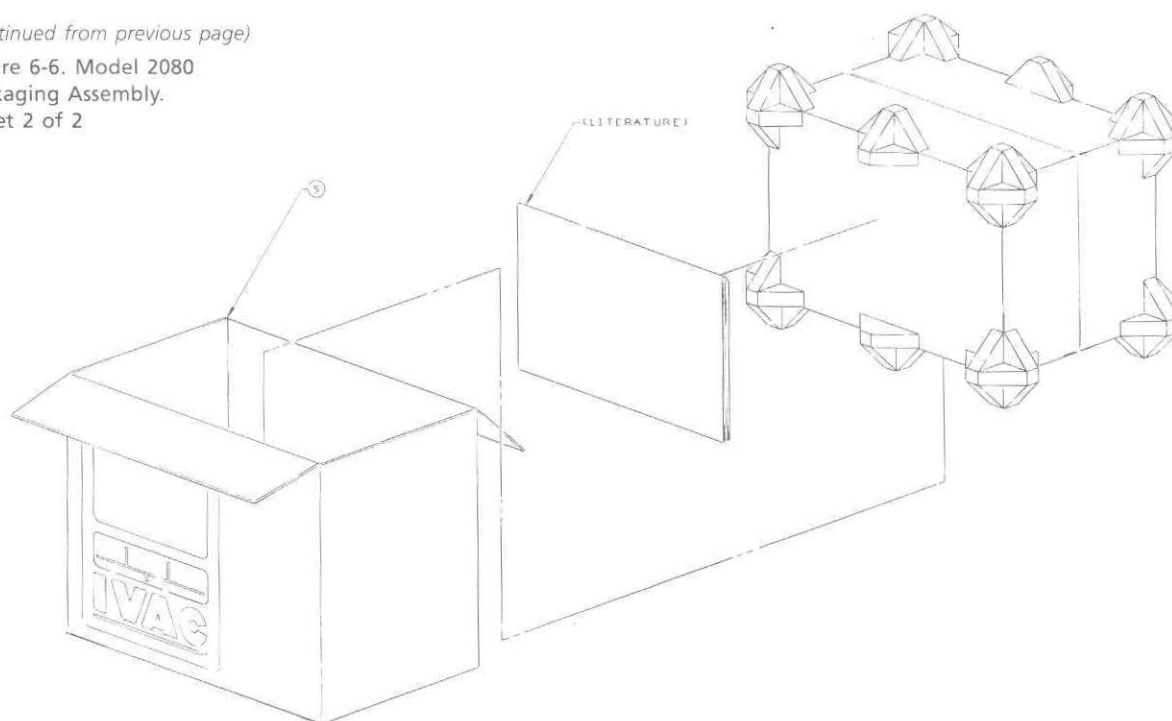
Figure 6-5. Model 2080
Label Literature Assembly.



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(continued from previous page)

Figure 6-6. Model 2080
Packaging Assembly.
Sheet 2 of 2



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FIG./ INDEX NUMBER	PART NUMBER	DESCRIPTION	QTY	REF DES
6-7	121915	ASSY,THERM BD,PRGM,2080		
004	122757	SPACER,2080	1	
005	303598	RES,CHIP,1/8W,1K OHMS	1	R031
006	303601	RES,CHIP,1/8W,5.1K OHMS	1	R026
007	303604	RES,CHIP,1/8W,8.66K OHMS	1	R030
008	303600	RES,CHIP,1/8W,10K OHMS	2	R027
				R028
009	303599	RES,CHIP,1/8W,20K OHMS	1	R019
010	303608	RES,CHIP,1/8W,24K OHMS	3	R006
				R007
				R025
011	303597	RES,CHIP,1/8W,47K OHMS	2	R024
				R033
012	303596	RES,CHIP,1/8W,51K OHMS	2	R020
				R021
013	303605	RES,CHIP,1/8W,82.5K OHMS	1	R029
014	303595	RES,CHIP,1/8W,100K OHMS	14	R008
				R009
				R012
				R013
				R014
				R015
				R016
				R017
				R018
				R022
				R032
				R036
				R038
				R040
016	303603	RES,CHIP,1/8W,100K OHMS	3	R034
				R035
				R037
017	303602	RES,CHIP,1/8W,150K OHMS	1	R010
018	303594	RES,CHIP,1/8W,120K OHMS	3	R001
				R002
				R003
019	303607	RES,CHIP,1/8W,330K OHMS	1	R011
020	303593	RES,CHIP,1/8W,1M OHMS	1	R023
022	12183	RES NTWK, REF DIV, 7 RES,0.1%	1	RN002
023	121847	RES NTWK,CAL DIV,5 RES,0.035%	1	RN001
024	303592	RES NTWK,5.0717K OHMS $\pm$.005%	1	R004
025	303576	CAP,M POLYCRB .47MF 5% 50VDC	1	C020
026	303584	CAP,TANT 33UF 10% 10V	1	C018
027	303582	CAP,TANT 1.0UF 10% 10VDC	1	C010
028	303578	CAP,MONO .1UF 20% 50VDC	10	C001

(continued on next page)

Illustrated Parts Breakdown

6 - 11

(Fig. 6-7 continued from previous page)

FIG./ INDEX NUMBER	PART NUMBER	DESCRIPTION	QTY	REF DES
				C002
				C003
				C004
				C005
				C006
				C007
				C008
				C009
				C019
029	303583	CAP,MONO .01UF 10% 50VDC	1	C017
030	303579	CAP,MONO 1000PF 10% 50VDC	5	C014
				C015
				C016
				C021
				C022
031	303581	CAP,MONO 33PF 5% 50VDC	2	C011
				C013
032	303580	CAP,MONO 22PF 5% 50VDC	1	C012
033	303591	DIODE,SCHOTTKY,LL101C	9	CR001
				CR002
				CR003
				CR004
				CR005
				CR006
				CR007
				CR008
				CR009
034	303589	TRANS,BSR14	3	Q001
				Q004
				Q005
035	303588	TRANS,BSR16	3	Q002
				Q003
				Q006
036	303587	IC,ICL7612 OPAMP 8 DIP	1	U004
037	303571	IC,PRCN OPAMP/REF 8 DIP	1	U003
038	303568	IC,LP339M14A,L PWR COMP,14 DIP	1	U005
039	303572	IC,CMOS 16 DIP	1	U002
040	303574	IC,4001 CMOS 2-IN NOR 14 DIP	1	U006
041	303575	SPKR,SEC-2437P	1	LS001
042	303573	PHOTOCELL,PLASTIC ENCAPSULATED	1	LDR001
043	303141	CRYSTAL,32.768KHZ	1	Y001
044	303609	JACK,MODULAR PHONE	2	J001
				J002
045	127688	SWITCH,MAG REED,ENCAP,2080	1	S003
046	303586	SW,SLIDE SPST BD01	1	S002
047	303585	SW,LIM SPDT D2A-1220	2	S004
				S005

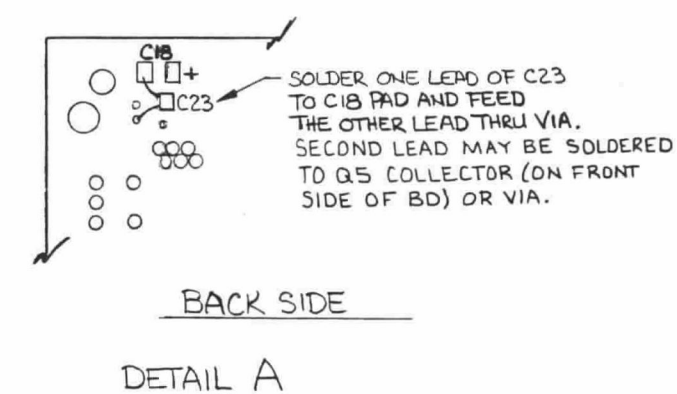
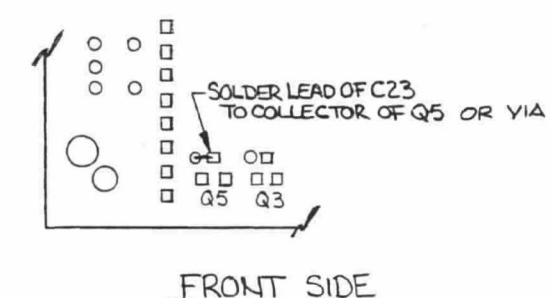
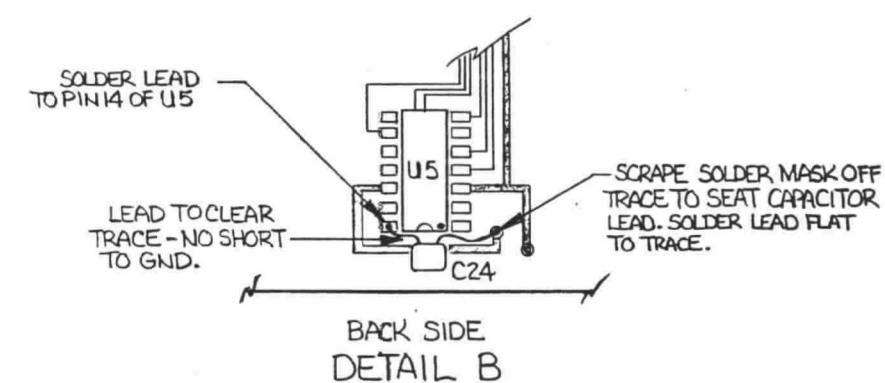
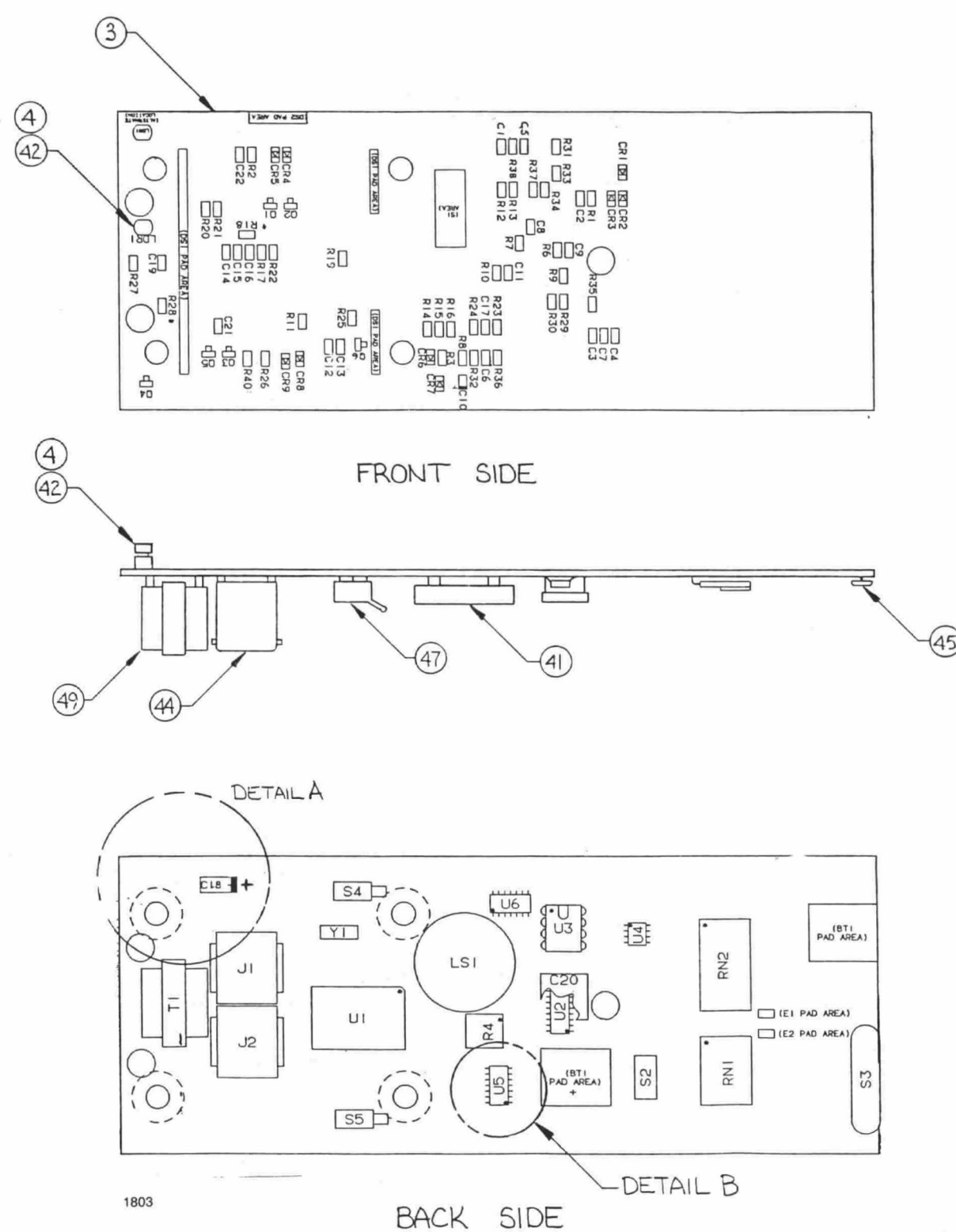
(continued on next page)

Illustrated Parts Breakdown

(Fig. 6-7 continued from previous page)

FIG./ INDEX NUMBER	PART NUMBER	DESCRIPTION	QTY	REF DES
048	122791	IC,CPU,PRGM,2080(BOM)	1	U001
049	121822	XFMR,EL BACKLIGHT,2080	1	T001
050	EO53277	2080 UPDATE	1	
051	301979	CAP,CER .10UF 20% 50V	2	C023 C024
052	EO53297	2080 UPDATE	1	
053	EO53352	2080 UPDATE	1	

Figure 6-7 Model 2080
Thermometer Board Assembly



MODEL(S) AFFECTED

2080, 2080A, 2085

DATE

DEC 1990

BULLETIN NUMBER

270

1 6

SHEET _____ OF _____

Subject 1: An IVAC probe simulator fixture is available for field use that can be used to verify calibration of the TEMP PLUS II Model 2080, 2080A and 2085 thermometers.

Reason 1: The Model 2080 Service Manual, section 5.3, describes the use of the probe simulator. Additions and corrections are needed to provide complete usage and maintenance information for the probe simulator fixture. (See Figure 1.)

Action 1: Replace Section 5.3.1 of Model 2080 Service Manual with information in this bulletin on:

- 1) Verifying calibration of Models 2080, 2080A and 2085 thermometers. (See page 2.)
- 2) Verifying calibration of the probe simulator fixture. (See page 4.)
- 3) Repairing the probe simulator fixture. (See page 5.)

Subject 2: The table in step c of section 5.3.2 on page 5-4 of the Model 2080 Service Manual needs updating.

Reason 2: Misprint in thermometer readings.

Action 2: Refer to the table below for correct equivalent thermometer readings in degrees to resistance.

<u>Resistance Decade (Ohms)</u>	<u>Thermometer Reading</u>
9254.3	$80.2 \pm 0.2^{\circ}\text{F}$ ($26.7 \pm 0.1^{\circ}\text{C}$)
6098.6	$98.0 \pm 0.2^{\circ}\text{F}$ ($36.7 \pm 0.1^{\circ}\text{C}$)
6015.9	$98.6 \pm 0.2^{\circ}\text{F}$ ($37.0 \pm 0.1^{\circ}\text{C}$)
5570.9	$102.0 \pm 0.2^{\circ}\text{F}$ ($38.9 \pm 0.1^{\circ}\text{C}$)
4895.6	$107.8 \pm 0.2^{\circ}\text{F}$ ($42.1 \pm 0.1^{\circ}\text{C}$)

NOTE

- Calibration verification of the Model 2080 2080A, and 2085 thermometers is necessary:
 - 1) Whenever the thermometer is repaired.
 - 2) Once every six months as part of preventative maintenance program.
- Calibration verification of the probe simulator fixture is necessary once a year as part of preventative maintenance program.

5.3.1 USING PROBE SIMULATOR

5.3.1.1 CALIBRATION VERIFICATION OF THERMOMETER

Calibration verification of a Model 2080, 2080A and 2085 thermometer needs to be verified whenever an instrument is repaired or once every six months.

A. Equipment Required:

IVAC Probe Simulator fixture, P/N 190676 (Formerly TE1137)

B. Procedure:

1. Disconnect and remove the thermometer's probes from the thermometer. (See Figure 2.)
2. Connect the probe simulator's phone plug to the thermometer's number 1 probe jack and verify that MONITOR MODE is displayed on the LCD display. (The jack numbers are molded into the rear case and are slightly above the jacks.)
3. Set the probe simulator to 80.2°F.
4. Verify that the display reads $80.2 \pm 0.2^{\circ}\text{F}$ ($26.7 \pm 0.1^{\circ}\text{C}$).
5. Set the probe simulator to 102°F, and verify the display reads $102.0 \pm 0.2^{\circ}\text{F}$ ($38.9 \pm 0.1^{\circ}\text{C}$).
6. Set the probe simulator to B.P. and verify thermometer reading is $106.0 \pm 0.2^{\circ}\text{F}$ ($41.1 \pm 0.1^{\circ}\text{C}$). Press the broken probe button and verify the thermometer displays BROKEN PROBE 1. (BROKEN PROBE 2 when the second probe connector is tested.)

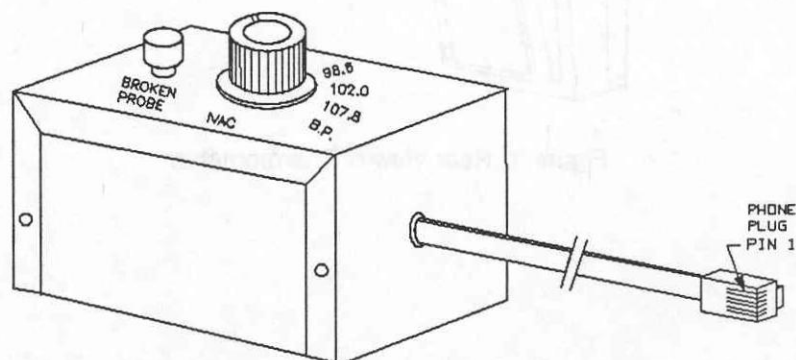


Figure 1. Probe Simulator, P/N 190676.

7. Connect the probe simulator to the other probe jack and repeat steps 3 through 6.

NOTE

Other temperatures can be checked at operator's discretion by setting the probe simulator to the desired setting. Verify thermometer reading using the table below.

Simulator Setting	Thermometer Reading
80.2	$80.2 \pm 0.2^{\circ}\text{F}$ ($26.7 \pm 0.1^{\circ}\text{C}$)
98.0	$98.0 \pm 0.2^{\circ}\text{F}$ ($36.7 \pm 0.1^{\circ}\text{C}$)
98.6	$98.6 \pm 0.2^{\circ}\text{F}$ ($37.0 \pm 0.1^{\circ}\text{C}$)
102.0	$102.0 \pm 0.2^{\circ}\text{F}$ ($38.9 \pm 0.1^{\circ}\text{C}$)
107.8	$107.8 \pm 0.2^{\circ}\text{F}$ ($42.1 \pm 0.1^{\circ}\text{C}$)
B.P	$106.0 \pm 0.2^{\circ}\text{F}$ ($41.1 \pm 0.1^{\circ}\text{C}$)

8. Calibration verification is complete. Disconnect the probe simulator and install the probes onto the thermometer. If the thermometer does not pass the calibration verification, then the thermometer needs repair.

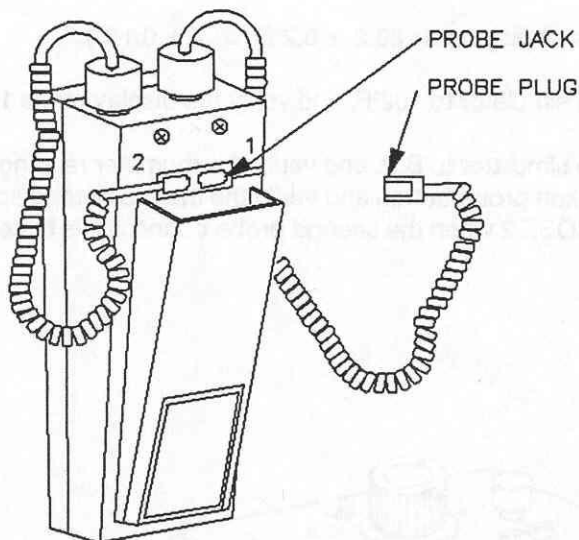


Figure 2. Rear View of Thermometer.

5.3.1.2 CALIBRATION VERIFICATION OF PROBE SIMULATOR

IVAC does not provide calibration service and repairs for the probe simulator fixture. Calibration of the probe simulator needs to be verified at least once a year. The following is the procedure to verify calibration of the probe simulator.

A. Equipment Required:

FLUKE Multimeter Model 8800A or equivalent 5 1/2 digit meter.

B. Procedure:

1. Set multimeter to K OHMS, RANGE 20.
2. Measuring from pin 3 to pin 4 of the probe simulator's phone plug (see Figure 3), verify the following readings:

<u>Simulator Setting</u>	<u>Multimeter Reading</u>
80.2	9.252K to 9.256K
98.0	6.097K to 6.100K
98.6	6.015K to 6.017K
102.0	5.570K to 5.572K
107.8	4.895K to 4.897K
B.P	5.094K to 5.096K
BP and BROKEN PROBE Switch pressed	Open circuit

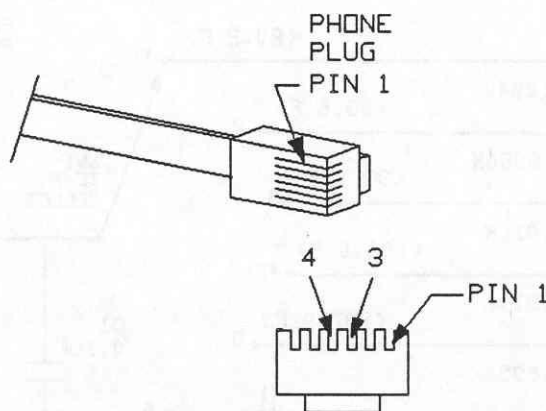


Figure 3. Probe Simulator's Phone Plug.

3. If the measured values do not fall within the specified ranges, then the probe simulator does not pass the calibration verification. Replace the related resistor and verify calibration again. See Figure 4 for wiring diagram of probe simulator.

5.3.1.3 PROBE SIMULATOR PARTS LIST

IVAC does not sell parts for the probe simulator fixture. Here is a list providing descriptions of replaceable parts used on the probe simulator. Use the list in conjunction with Figure 4.

ITEM	PART NO.	DESCRIPTION	QTY	REF
V002	*	SWITCH, ROTARY, 1 POLE-12 POSITION, C&K A112-15-N-Z-Q	1	S1
V003	*	SWITCH, PUSHBUTTON, SPDT ON-MOMENTARY, C&K 81252HZBE	1	S2
V006	*	PLUG, MODULAR, AMP #5-641137-3	1	
V007	*	CAPACITOR, 0.1 μ F, 20% 50V, CERAMIC	1	C1
V012	*	RESISTOR, 9.254K, 0.01%, 0.05W	1	R1
V013	*	RESISTOR, 6.0986K, 0.01%, 0.05W	1	R2
V014	*	RESISTOR, 6.016K, 0.01%, 0.05W	1	R3
V015	*	RESISTOR, 5.571K, 0.01%, 0.05W	1	R4
V016	*	RESISTOR, 4.8956K, 0.01%, 0.05W	1	R5
V017	*	RESISTOR, 5.0953K, 0.01%, 0.05W	1	R6

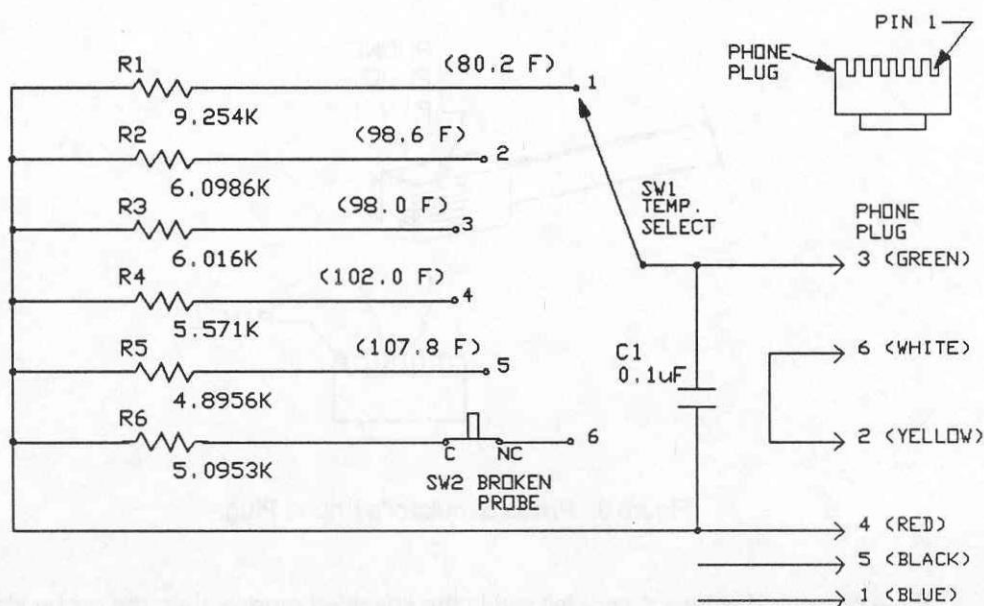


Figure 4. Wiring Diagram for Probe Simulator.

Technical Inquiries:

For additional assistance, contact Technical Support in IVAC Field Service Operations (domestic or international).

Address: IVAC Corporation
10300 Campus Point Drive
San Diego, California 92121-1579 USA

Attn: Field Service Operations

Telephone: (619) 458-6003 for Field Service Operations
(800) 854-7128 for toll-free assistance (USA only)

FAX: 1-619-458-7760

Telex: 276051 ELI LILLY IND A (Identify IVAC San Diego as destination.)

MODEL(S) AFFECTED

Models 2080 and 2080A

DATE

5/25/88

BULLETIN NUMBER

247

SHEET 1 OF 6

SUBJECT: Operational and technical differences between the IVAC Models 2080 and the 2080A Electronic Thermometers.

REASON: To inform the user of the various differences in the functions of the two thermometers and to explain the technical variations. This Service Bulletin will explain the operational differences and also contains a listing of parts and drawings to be included in your Model 2080 Technical Manual.

REFERENCES: Technical Manual for the Model 2080 and Directions For Use for both the Models 2080 and 2080A.

EXPLANATORY INFORMATION: The following will highlight the functional differences between the two thermometers.

START-UP/OPERATIONAL CHECK

Model 2080: Once the display and self-test is complete the display will read 80°F (26.7°C) indicating the instrument is ready for use.

Model 2080A: When both probes are installed, once the display and self-test is complete, the instrument will display three dashes (---) indicating that the instrument is ready for use. With only one probe installed, the 2080A will function as the 2080 mentioned above.

ANTITHEFT TIMER

Model 2080: The instrument will emit three long beeps and the pulse and temperature features will be disabled. The display will continue to flash the RETURN TO BASE message until the instrument is returned to base.

Model 2080A: The instrument will continuously beep and display the RETURN TO BASE message until it is returned to its home base. The pulse and temperature features of the unit will be disabled.

NOTE: The time period for the antitheft timer is factory set for 8 hours. Consult the Model 2080 Technical Manual for optional times.

NOTE: Remove batteries to prevent antitheft activation when returning instrument for repair.

MONITOR MODE - AXILLARY TEMPERATURE MEASUREMENT METHODS
(See Directions For Use For Detailed Procedures)

Model 2080:

- Allow the temperature display to reach 92.0°F (33.3°C), then remove the second probe from the storage well. Watch for BOTH PROBES OUT to appear in the display, then reinsert the second probe into the storage well. The display will momentarily indicate 80.0°F (26.7°C) before switching to monitor mode. MONITOR MODE will appear in the display indicating start of monitor mode measurment.
- Install Monitor Probe Adapter, Model 2868, and follow the instructions in the Model 2080 Directions For Use.

Model 2080A:

- Push and hold the PULSE TIMER button while removing one of the probes. When the display sequence is completed, indicated by three dashes (---) in the display, release the Pulse Timer button. MONITOR MODE will be displayed along with the three dashes in the display. If only one probe is installed in the instrument the three dashes will not appear. Instead, the temperature of the probe will be displayed immediately after the self-test.
- Install Monitor Probe Adapter, Model 2868, and follow the instructions in the Model 2080A Directions For Use.
- Use the first method mentioned above for the Model 2080, but allow the temperature to reach 94.0°F (34.4°C) before removing the second probe.

TECHNICAL INQUIRES: For added technical assistance, in USA (domestic) contact IVAC Service Field Operations, or outside USA (international) contact IVAC International Technical Service.

Address: IVAC Corporation
10300 Campus Point Drive
San Diego, California 92121-1579, USA

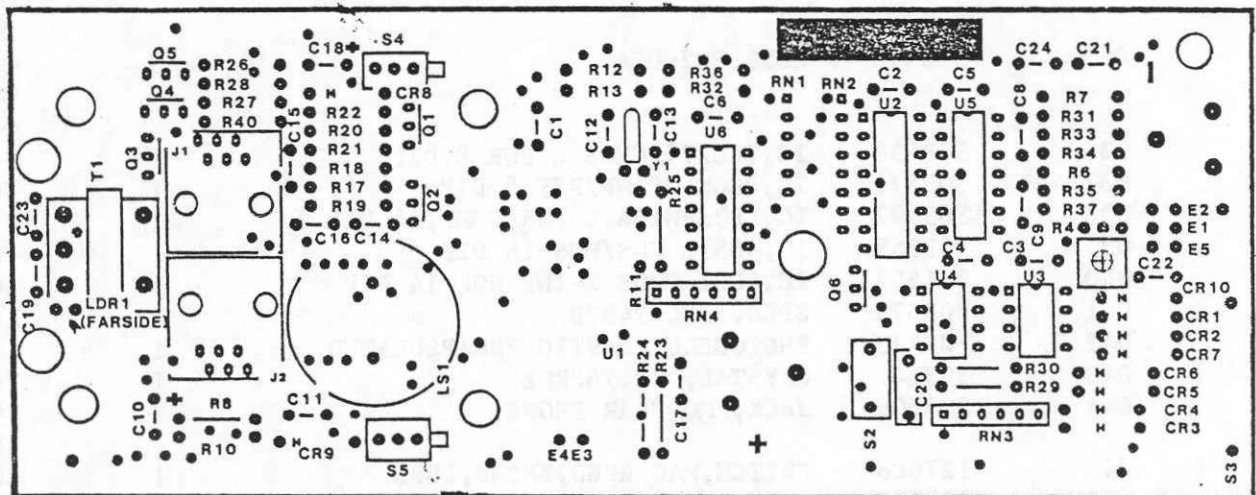
Attn: Service Field Operations 27/2 (domestic)
Attn: International Technical Service 7/2 (international)

Telephone: Service Field Operations
1-800-854-7128 ext.7504
1-619-458-7504

Telephone: International Technical Service
1-619-458-7140
Fax: 1-619-458-7760
Telex: 276051 ELI LILLY A (identify IVAC San Diego as destination)

ITEM	PART NUMBER	DESCRIPTION	QTY	REF DES
	129884	ASSY,THERM BD,PRGM,2080A		
005	300137	RES,CF 1/4W 1.0K 5%	1	R031
006	300154	RES,CF 1/4W 5.1K 5%	1	R026
007	302394	RES,MET F 1/4W 8.66K 1%	1	R030
008	300161	RES,CF 1/4W 10K 5%	2	R027
				R028
009	300168	RES,CF 1/4W 20K 5%	1	R019
010	300170	RES,CF 1/4W 24K 5%	3	R006
				R007
				R025
011	300177	RES,CF 1/4W 47K 5%	1	R024
012	300178	RES,CF 1/4W 51K 5%	2	R020
				R021
013	301449	RES,MET F 1/4W 82.5K 1%	1	R029
014	300185	RES,CF 1/4W 100K 5%	9	R008
				R012
				R013
				R017
				R018
				R022
				R032
				R036
				R040
016	300486	RES,MET F 1/4W 100.0K 1%	3	R034
				R035
				R037
017	300458	RES,MET F 1/4W 150.0K 1%	1	R010
018	300202	RES,CF 1/4W 510K 5%	1	R033
019	300197	RES,CF 1/4W 330K 5%	1	R011
020	300209	RES,CF 1/4W 1M 5%	1	R023
022	121839	RES NTWK, REF DIV, 7 RES,0.1%	1	RN002
023	121847	RES NTWK, CAL DIV, 5 RES,0.035%	1	RN001
024	303592	RES NTWK, 5.0717K OHMS $\pm$.005%	1	R004
025	303576	CAP,M POLYCRB .47MF 5% 50VDC	1	C020
026	301413	CAP,TANT 33UF 10% 10V	1	C018
027	301057	CAP,TANT 1UF 10% 35V	1	C010
028	301979	CAP,CER .10UF 20% 50V	9	C001
				C002
				C003
				C004
				C005
				C006
				C007
				C008
				C009
				C019
029	302490	CAP,CER .01UF 20%50V	1	C017

ITEM	PART NUMBER	DESCRIPTION	QTY	REF DES
030	301778	CAP,CER .001UF 10% 50V	5	C014 C015 C016 C021 C022
033	302405	DIODE,SCHOTTKY IN5713	10	CR001 CR002 CR003 CR004 CR005 CR006 CR007 CR008 CR009 CR010
034	301928	XSTR,MPS/NP/PN/2222A(+)	3	Q001 Q002 Q005
035	302455	XSTR,PN2907A	3	Q002 Q003 Q006
036	303698	IC,TLC271 CMOS L PWR 8 DIP	1	U004
037	303571	IC,PRCN OPAMP/REF 8 DIP	1	U003
038	303697	IC,LP339N14A,L PWR COMP,14 DIP	1	U005
039	302283	IC,4051B COS/MOS 16 DIP	1	U002
040	301557	IC,4001 CMOS 2-INP NOR 14 DIP	1	U006
041	303575	SPKR, SEC-2437P	1	LS001
042	303573	PHOTOCELL,PLASTIC ENCAPSULATED	1	LDR001
043	303141	CRYSTAL, 32.768KHZ	1	Y001
044	303609	JACK, MODULAR PHONE	2	J001 J002
045	127688	SWITCH,MAG REED,ENCAP,2080	1	S003
046	303586	SW,SLIDE SPST BD01	1	S002
047	303585	SW,LIM SPDT D2A-1220	2	S004 S005
048	128958	IC,CPU,PRGM,2080	1	U001
049	131389	XFMR,EL BACKLIGHT,2080	1	T001
051	301979	CAP,CER .10UF 20% 50V	2	C023 C024
052	303700	CAP,CER 22PF 5% 100V	1	C012
053	303699	CAP,CER 33PF 5% 100V	2	C011 C013
054	303701	RES NTWK, 6 SIP 5R 120K 2%	1	RN003
055	303702	RES NTWK, 6 SIP 5R 100K 2%	1	RN004
056	303707	RES,CF 1/8W 100K 5%	4	R012 R013 R032 R036



Model 2080A - Thermometer Board Assembly

NOTES (UNLESS OTHERWISE SPECIFIED):

1. RESISTOR VALUES ARE IN OHMS, 4 MATT, 5X.
2. CAPACITOR VALUES ARE IN MICROFARADS.
3. DIODES ARE 1N5713.

REV. 02 SOFTWARE AND ABOVE

FUNCTION	E1	E2
ANTI-THEFT	0	0
DEEP 3 TIMES	0	0
DEEP CONT.	0	0

0-OPEN
C-CLOSED

REV. 00 SOFTWARE AND ABOVE

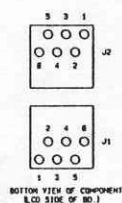
FUNCTION	E1	E2
ANTI-THEFT	0	0
DEEP 3 TIMES	0	0
DEEP CONT.	0	0

0-OPEN
C-CLOSED

REV. 01 SOFTWARE AND ABOVE

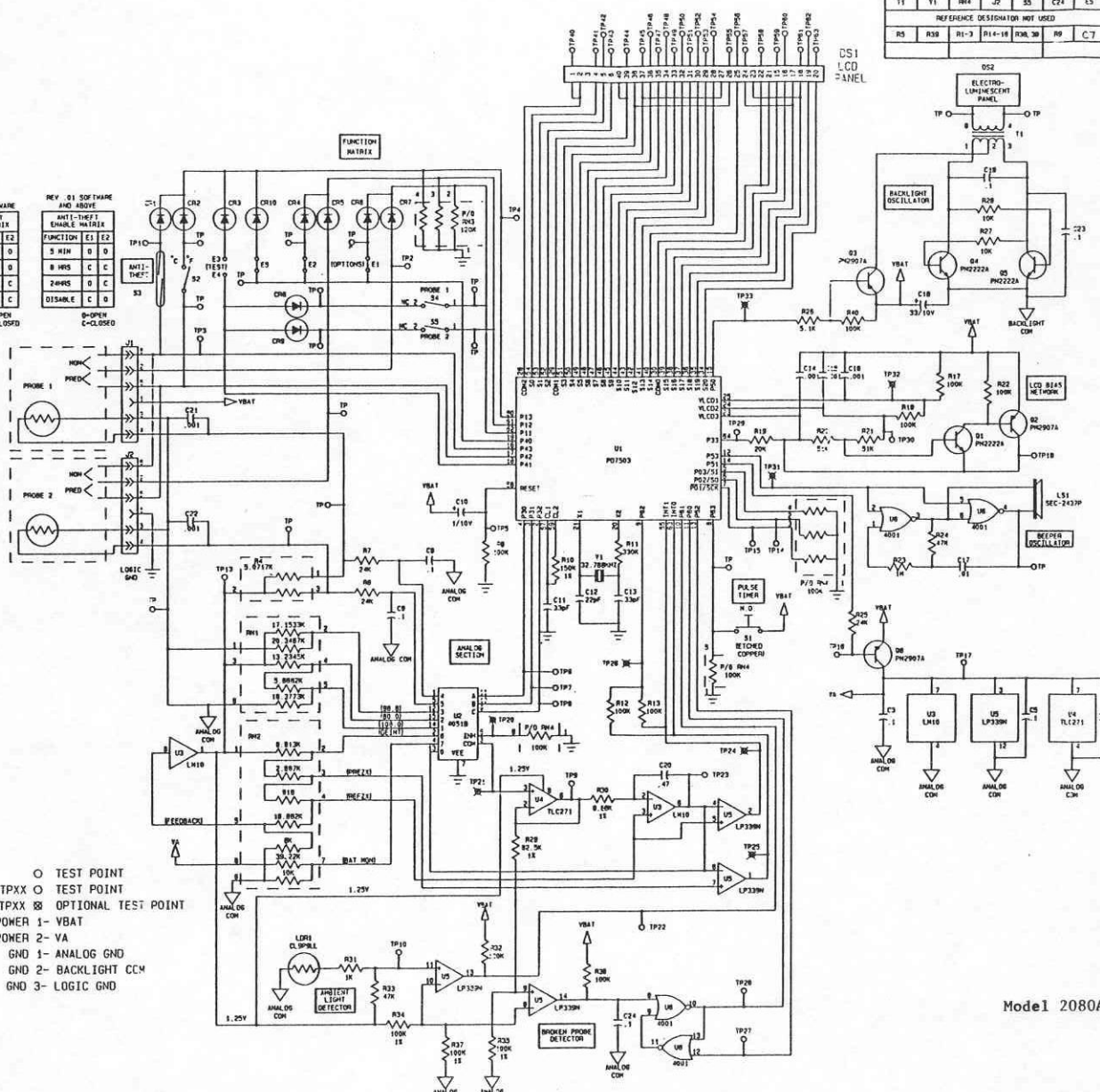
FUNCTION	E1	E2
ANTI-THEFT	0	0
DEEP 3 TIMES	0	0
DEEP CONT.	0	0

0-OPEN
C-CLOSED



BOTTOM VIEW OF COMPONENT J2 AND J1

○ TEST POINT
TPXX ○ TEST POINT
TPXX ⊗ OPTIONAL TEST POINT
POWER 1- VBAT
POWER 2- VA
GND 1- ANALOG GND
GND 2- BACKLIGHT COM
GND 3- LOGIC GND



HIGHEST REFERENCE DESIGNATOR USED

U1	U2	U3	U4	U5	U6	U7	U8	U9	U10	U11	U12	U13	U14	U15	U16	U17	U18	U19	U20	U21	U22	U23	U24	U25	U26	U27	U28	U29	U30	U31	U32	U33	U34	U35	U36	U37	U38	U39	U40	U41	U42	U43	U44	U45	U46	U47	U48	U49	U50	U51	U52	U53	U54	U55	U56	U57	U58	U59	U60	U61	U62	U63	U64	U65	U66	U67	U68	U69	U70	U71	U72	U73	U74	U75	U76	U77	U78	U79	U80	U81	U82	U83	U84	U85	U86	U87	U88	U89	U90	U91	U92	U93	U94	U95	U96	U97	U98	U99	U100
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Model 2080A - Thermometer Board Schematic